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THE COAL INDUSTRY OF THE WORLD.

BY S. H. FINCH.

[Written for the AMERICAN RAILROAD JOURNAL.]

WHILE it is believed that the construction and maintenance of the plant of railway and kindred enterprises requires all the skill in design and selection of proper materials entering into each member of so varied structures as are connected therewith, and much more than is usually allotted, and that it is desirable in the highest degree that special care be taken in the training and educating of competent constructors in order to meet upon equal terms, present or future competitors; it is also considered within the limits of the economic section of engineering to discuss the commercial features of such enterprises. In accordance with this belief the following glimpse of the coal production of the world, together with mention of new uses and extended territory for coal trade is submitted for the consideration of readers of the AMERICAN RAILROAD JOURNAL.

The great coal-beds of this country lie in six detached areas, and are styled respectively, the Rhode Island, Appalachian, Michigan, Illinois, Missouri, and Texas coal-fields. The Rhode Island is the smallest, and comprises an area of only one thousand square miles. The Missouri is the largest, and covers about one hundred thousand square miles.

The era or period of carbon deposits was initiated by the formation of the conglomerated sandstone known as the millstone grit, and which contains thin seams of coal, but is often called the false coal measures. During this period, the fishes and ferns of the Devonian age were buried beneath vast accumulations of sand and gravel, and only occasional seasons of quiet occurred, when vegetation would make some progress.

The coal measures proper, present rocks of every kind, sandstone, shales, limestone, etc. They can be distinguished from the other strata only by their fossils. The thickness of the coal-bed is at places not more than that of a sheet of paper; at others it is from thirty to forty feet. The "mammoth vein," exposed to view at Wilkesbarre, Pa., and worked at Mauch Chunk, Shamokin and other places, is twenty-nine and a half feet thick. The Pittsburg seam is eight feet thick and may be traced for a long distance as a conspicuous black band along the high banks of the Monongahela, and it is estimated that for every foot in thickness, a coal-bed produces one million tons per square mile. Iron ore is also abundant in the coal regions, and is distributed in nodules, often of great weight, or in thin seams so as to injure the coal-getting to a considerable extent.

Baussingault calculates "that luxuriant vegetation of the present day takes about half a ton of carbon from the atmosphere annually," or 50 tons per acre in a century. Fifty tons of coal spread over an acre would make a layer of less than one-third of an inch in thickness; but assume that it is half an inch, then the time required for an accumulation of a seam of coal three feet thick—about as thin as can be worked advantageously—would be 7,200 years. In the coal measures of Nova Scotia there are seventy-six seams of coal, one of which is thirty-seven feet thick, another twenty-two.

Plants are the characteristic fossils of this period. Everywhere the shales bear impressions of the delicate tracery of ferns, leaves and stems depicted with the sharpest outlines. Trunks of trees, erect or prostrate, appear with their roots yet embedded in the layer of clay, the soil in which they grew underneath the coal, and reveal perfectly the vegetation of the period. The leading forms are tree-ferns, rushes and club-masses, which grew to a size unknown in our climate, and the ferns which to-day creep at our feet, then towered into stately trees with trunks a foot and a half in diameter. They are abundant as fossils and doubtless contributed largely to the formation of coal. Dr Buckland says: "The most elaborate imitations of living foliage upon the painted ceilings of Italian palaces, bear no comparison with the beauteous profusion with which the galleries of these instructive coal mines are overhung; the roof is covered as with a canopy of gorgeous tapestry, enriched with festoons of most graceful foliage, flung in wild, irregular profusion over every portion of its surface."

The surprising increase in coal production during the last thirty-five years is of such magnitude as to claim some notice, being about as follows:

Great Britain extracted in	1845	31,500,000	tons.
	1874	125,043,000	"
	1884	143,500,000	"
Belgium extracted in	1845	4,960,000	"
	1874	14,669,000	"
	1884	16,250,000	"
France extracted in	1845	4,142,000	"
	1874	16,949,000	"
	1884	20,000,000	"
Prussia extracted in	1845	3,500,000	"
	1874	41,754,600	"
	1884	45,500,000	"
Austria & Hungary ext'd in	1845	709,706	"
	1874	12,810,900	"
	1884	13,900,000	"

From these five countries the combined production will be seen to have risen from 44,811,700 tons in 1845, to 211,200,000 tons in 1874, and to 339,150,000 tons in 1884. While the production in the United States was, in the year 1845, only 4,400,000 tons, in 1874 it had reached 42,423,900 tons, so that the total increase in the output of coal for the world was nearly 205,000,000 tons from 1874 as compared with the year 1845.

Statistics are not available for determining the increased uses or demands for coal which, however, may or may not be in the gross proportionate for so extended a period, and a consideration of existing circumstances affecting the present outlook for the anthracite coal trade will be

of much more interest than opinions or comparisons of comparatively remote periods.

The total production of anthracite for	1873 was	21,263,220	tons.
"	" 1874	20,178,613	"
"	" 1875	19,725,471	"
"	" 1876	18,535,557	"
"	" 1877	20,847,681	"
"	" 1878	17,605,262	"
"	" 1879	26,142,689	"
"	" 1880	23,437,242	"
"	" 1881	28,500,016	"
"	" 1882	29,120,096	"
"	" 1883	31,790,000	"
and it will be say for 1884		32,500,000	"

The high calorific power of anthracite, and the low percentage of sulphur and ash contained in most varieties, naturally render it of great value as a fuel in the cupola and the blast-furnace, while from its abundance and the small cost with which it may be generally worked, it should be at once the cheapest and best fuel that could be used.

This is doubtless generally recognized, and the accompanying table showing the total pig-iron production of the world is believed to warrant this belief, as the growth and development of pig-iron production is the result of coal mining:

	1850.	1860.	1870.	1875.	1883.
Great Britain	2,249,998	3,700,000	5,963,515	6,365,462	8,490,224
United States	564,755	815,595	1,659,850	2,017,257	4,595,510
Germany	400,000	600,000	1,236,449	1,743,801	3,380,788
France	141,563	313,544	553,929	529,663	770,669
Austria and Hungary	235,000	325,000	394,899	446,122	420,300
Russia	222,998	291,000	352,517	420,484	*462,027
Sweden	139,389	181,434	294,460	343,680	391,000
Spain	50,000	50,000	50,000	75,000	85,000
Italy	25,000	25,000	25,000	25,000	25,000
Norway	9,800	7,500	3,890	3,800	5,600
Others estimated	50,000	50,000	50,000	50,000	50,000

—*Russia 1880, 1883 not known.

It goes without saying that there is a very extended stagnation in all trades, but the belief is almost universal that the general business of the country will soon show signs of improvement, and the coal trade must receive some share of it. If the carrying companies should—as it is reported they have agreed to do—restrict shipments in order to advance prices by the aid of combination, it must result in a sacrifice of the near future for expected present benefits which will be comparatively small, although some kind of combination may be and doubtless is necessary to protect the immense sums involved in coal producing and transportation.

The cost of mining and hauling to the seaboard or consuming districts is now probably as low as rigid economical supervision can make it, and the further reduction of this expense may only be expected by the further introduction of labor-saving machinery in cutting and making ready for market, by the improvement of vehicles used in transport, by the erection of apparatus at tide-water for trans-shipments with a minimum of manual labor, and by a continually increased adaptation of means for producing given results, and, to secure which, the employment of higher-class skill in superintendence as exemplified in technical education, directed to the management and development of this specialty as well as the gain sure to follow the improved condition of the men engaged in coal-getting.

It is often stated with respect to the unproductive employment of labor as a common proposition, that while there is but little to do and thousands are out of employment, any change which reduces the number of unskilled workmen is not desirable. Yet there can be no doubt of the fallacy of such argument. To increase consumption and consequently production, the value of commodities must be reduced by economic methods, and the very reasons which are often urged as causing trade depression are the means to employ for its increase.

This country is not without evil prophets, and the present state particularly of the coal and iron trade seems to give some weight to their forebodings that trade will never rise again to what it has been. Because coal is a drug in the market, and the manufacture of iron no longer profitable, no one need conclude that the consumption is falling off. The reason coal is so unremunerative to the producer is not altogether on account of the consumption, but that too much coal has and is still being mined. But as coal is so large a factor in the cost of iron-making, it is fortunate that to the low price of iron we have not to add a scarcity of fuel.

Coal and iron are continually increasing in quantities consumed; more trade will be done but at no profit, and the cause of the low prices can only be found in the power of production having been too much increased in consequence of so much capital having been tempted into the trade by the high prices.

The present suffering is then the result of natural consequences and reaction, and there can be no reason for charging it entirely to non-consumption.

POPULAR RAILWAY EXCURSIONS.

BY HARRIS T. GURNEY.

[Written for the AMERICAN RAILROAD JOURNAL.]

AMERICANS are essentially sight-seers, and it is only necessary for a "celebration" to be announced as occurring in any locality, when the various railways are ready with popular excursions at reduced rates to the point of interest. The numerous centennial celebrations which have been inflicted upon the country during the past eight or nine years have, in great measure, stimulated a desire on the part of its inhabitants for brief excursions in which they can indulge at a comparatively small cost; and it is rare that a year passes without celebrations of some sort being provided that will gratify this desire. The winter carnival at Montreal with its ice-palace and other varied attractions has come to be regarded as a fixture, and excursion tickets are sold to the Canadian metropolis at very much reduced rates. As a result there is a great influx of people from the States, and the carnival is yearly becoming more elaborate. This winter the exposition at New Orleans will be a favorite tour for our roving population, while the inauguration of President-elect Cleveland affords a fine opportunity for the announcement of railway excursions, since Washington will then be regarded as the Mecca of the Democracy.

We are a hard-working people, and these occasional trips are not to be grudged us. The expense attending them is generally slight, and if they serve no other purpose they will at least remove the cobwebs from tired heads that have been bending over law-books and ledgers for many weary months. Rather should the railway excursion be encouraged as an institution that affords us more solid pleasure in direct ratio to the expense incurred than any other diversion. There is, however, at present a lack of system in these excursions for which the railways are not entirely responsible. The marked events serving

as pretexts for the excursions occur at irregular intervals, and frequently two take place at the same time, which "simultaneousness" robs each of a full degree of success.

I am not sufficiently versed in the accounts of the various railways to form an estimate as to the profits resulting from these popular excursions, but since the railways are always ready to announce them at reduced rates, it is fair to presume that they are profitable, for I am not quite ready to believe that railways cut their rates through philanthropy alone; and if they are profitable it would be well for the railways to assist in furnishing the celebrations. They are not difficult to arrange, and as a rule not over-expensive. Certainly the receipts from the spectators more than cover expenses, and as everybody is contented it is fair to assume that were these celebrations increased in number, the profits to the railways would be still greater.

As it now stands, the chief attractions to the spasmodic traveler—an individual who is tempted through low rates and an economy of time to make a hurried pleasure-trip—occur in winter. In the summer months when trade is at its dullest there are few events occurring of more than passing interest, and consequently but few railway excursions. The fourth of July is generally a day when the traveler can find a ticket to certain points at reduced rates but there is little occurring to prompt him to the journey. The national conventions of our two great political parties are but quadrennial occurrences and are not over-attractive even at these rare intervals to the peaceable American. Undoubtedly there are a number of wonderful spots where natural scenery abounds in great profusion and beauty, but they are there for all time, and one is not prompted to embrace the opportunity of visiting them by that great American force of reasoning: "You will never have another chance of seeing them." The centennial exposition in Philadelphia, in 1876, was the only favorite and popular excursion that has been offered us in the months when we are most likely to have the time at our disposal to embrace the opportunity of patronizing it.

In what direction, then, must we look for fields in which to extend the railway excursion to the proportions of a national institution? We have had our fill of expositions and with the close of the New Orleans exposition, our taste for that form of sight-seeing will have been subjected to a cloying process that will rob it of its zest for some years to come. We cannot have a Brooklyn Bridge opened every year, neither will the genius of history come to our aid with centennial occurrences of national interest. Mere sporting events do not awaken the interest on this side of the Atlantic that they do in England and the continent, and we have no "Derby day" to herald with grand and popular excursions. It is evident that the *raison d'etre*, so to speak, of popular excursions must be manufactured, and to this end the energies of railway managers, as the class most interested from a financial point of view, should be directed. As in the theatrical business, the public taste should be sounded and gratified. To speak metaphorically, if the public want spectacle give it to them; if they want tragedy, give it to them—though in this connection I do not wish to be understood as commending the enterprise of certain railways in the South which make a specialty of running excursion trains to witness executions—and if they prefer a mixture of drama and farce, why provide it with a lavish hand.

The points to be chiefly considered are three. In the first place the excursion should be inexpensive and within the reach of the many. For this reason the "attraction" should be something that does not depend upon sectional peculiarities to an extent that will confine it to a particular and remote section of the country. Second in importance comes the question of time. The popular excursion should occur at those periods when it can be patronized without detriment to business, and most fortunately this period is the identical period when the system most craves diversion—the summer months. Thirdly, the duration of the excursion should be brief. I do not mean that the "attraction," for I know of no other word to express my meaning, should be exhibited for a short time only, but that it may be possible for the visitor to indulge himself with the loss of but a few days from his regular employment. Let these conditions be fulfilled, and I am convinced that the patronage of the popular railway excursion would increase yearly until it became an established institution.

In advocating the increase of popular excursions under circumstances and with surroundings that would assure them great patronage, it is perhaps only fair to instance a possible "attraction" for a grand popular excursion that would appeal to everybody. Possibly the ungrateful railway officials may not thank me for mentioning it, but I will at any rate give them the benefit of the suggestion without hope of reward. Let all the trunk lines having termini in New York City contribute the trifling sum necessary to complete the Bartholdi statue pedestal and then arrange for an excursion at the erection of the statue that will distance in grandeur anything hitherto attempted. The very heavens should be painted red for the occasion, and the waters of the harbor dyed a rich vermilion to be in harmony with its surroundings. Seriously it would seem feasible to seize upon the erection of the statue—if the event is to occur during the existence of the present generation—as an occasion for a series of popular excursions, and it may occur to the railways that they have a possible interest in the completion of the pedestal.

One suggestion of this kind is enough and I dare not risk another; but it is evident that the American people are quick to avail themselves of the opportunity of travel if they can do so cheaply, at a period when they are least engaged with their several occupations and with the expenditure of but a few days' time. Above all are they prone to patronize such trips when they are offered something novel at the points of destination, and the ingenuity of the railways could be taxed with profit to provide this something, instead of waiting for history or Nature to furnish it, which they do at but rare intervals and with little regards to the convenience and inclination of poor mortals. That the ingenuity of railway managers would be taxed in vain to furnish the necessary objective attraction does not seem likely. As for that it would be a simple thing to offer a prize for the best suggestion relative to the attraction for a popular railway excursion, and I believe that very few days would elapse before a multitude of answers would be received. If necessary, "Indian cemeteries" and "relics of the Norsmen" can be built to order, and they would answer the purpose just as well as the genuine articles. Americans are only particular as to what the thing seems to be; they care not for the *is*; and under these circumstances it is an easy matter to cater to their tastes.

LUBRICATING AND LUBRICANTS.

BY E. F. DIETERICHS.

[Written for the AMERICAN RAILROAD JOURNAL.]

VIII.

CONCLUDING REMARKS.

ALL that has been said hitherto about lubricating machinery is likewise applicable to the lubricating of vehicles of all kinds and constructions, when also the best quality of lubricant is the cheapest and most efficient. Lubricants of gummy nature, and such as change their consistency under the influence of hot or cold weather, are unfit for use and injurious to the axles; and increasing the drag, needlessly exhaust the motive power employed. Unfortunately, here also false economy calls for cheap oils or grease, hence the endless number of inefficient and vilely adulterated oils and so-called axle-greases, redundant with rosin and all kinds of inert substances. For heavy vehicles, grease of good quality, and for light conveyances, oils free from tendency to gum or congeal or liquefy, should alone be used.

Before applying the lubricant, the axle, box and hub should be carefully cleansed from dirt and sand and the combined accumulations of dust and gummy deposits, and the lubricant should be applied as sparingly as possible, but as often as necessary to replace that which has been consumed before the axle becomes dry. Of oil very little is required, as the metallic surfaces of the box and axle alone require lubricating, and all reckless and needless pouring on of oil, thereby saturating the wood of the hub, is a useless expense, and gives rise to such silly complaints as "Injury to the wood from the use of mineral oils," when cheap and poor and unseasoned wood had been used by the manufacturer.

Lubricating is not solely limited to machinery and vehicles, but it constitutes also an important factor in the use of leather. Hide when deprived of its natural lubricating moisture becomes dry and the fibers when in motion against each other become brittle and are destroyed by the frictional heat. When converted into leather this also would soon become useless for wear, were it not for the interposition of fatty lubricants known as "stuffings of leather," which relieve the frictional action of fiber against fiber. Just as we have recourse to processes by which we harden and strengthen metals to make them more durable, so we try to protect leather and make it more durable by the different processes to which it is subjected; but unless the frictional action of fiber against fiber is relieved by lubrication, the frictional heat evolved must destroy the fiber, and here, also, as in lubricating machinery or vehicles, the lubricant has to be renewed from time to time as it has fulfilled its function, and the more volatile the fatty substances employed, the oftener they require renewal. Leather is much more susceptible to ravages by acids or alkalies than metal of which machinery is constructed, and the use of lubricants containing either should be most carefully avoided; equally so should inert matter be omitted in the composition of good leather oils and dubbings, since when the fatty parts of the lubricant, in filling its vocation, leaves this inert matter behind, it aids the abrasion of fiber against fiber when in motion. The application of blackings, dressings or varnishes to leather is intended to give it proper appearance on the surface, but unless the fibers are kept protected from time to time by good lubricating, these dressings, by the very nature of their compositions and their requirements, would seriously interfere with the life of the leather; but they can fulfill their purpose harmlessly if applied on the surface of leather well protected by a good lubricant. Such lubricant protects the leather also against the influence of the atmosphere, snow and rain, against ammonia emanating from perspiration of the feet in case of boots and shoes, or from the body of animals in the case of harness and, in case of belting, the alternate influence of dryness and moisture in workshops.

No drying oils should ever be used for lubricating, nor lubricants containing inert matter except for temporary relief. All mineral oils containing grit, or not entirely free from dangerous volatile constituents should be carefully discarded, and the selection of lubricants for purchase and use be guided solely by their purity and quality of material used in their manufacture, and not alone by their price. The best are the cheapest. Good lubricants can only be made or selected by those who intelligently understand the theory of lubricating and the characteristics of fatty matter.

That lubricating is of more importance than generally looked upon, is easily shown by the fact that not a wheel could be turned, not a sewing-machine used, no steamboats, locomotives and cars, or any kind of machinery moved, without the use of some lubricant.

THE INTERIOR DECORATION OF PASSENGER-CARS.

BY A. A. KELLY.

[A Paper read before the Master Car Painters' Convention, Boston, Mass.]

ABOUT a dozen years ago, and just prior to the business panic of 1873, the most lavish expenditure for ornamenting and upholstering of passenger-coaches was indulged in, and was carried to such excess that a reaction was finally the result, this being in accordance with the pretty thoroughly grounded rule that one extreme is sure to be followed by another of an opposite character. The rarest and richest woods were employed in fine cabinet work, trimmings and in other ornamental work, and the American passenger-coach was made only less regal and luxurious than the veritable palace. The years of business depression which followed the panic of the afore-mentioned year was not without its effect upon the railway companies, and by the instituting of the most stringent business and financial policy upon their part, many retrenchments were made, and in no direction more closely than in the car constructing and painting departments. Veneering, in its day deservedly popular and a vast improvement upon painted work, had been abandoned for the solid finishes. Now it was again adopted, and old coaches were brought out and their old veneerings scraped and revarnished, and made to look tolerably respectable. Others were painted or handsomely grained: and though these refurnished cars had the appearance of being second-hand at best, yet the plan pursued was not only in perfect ac-

cord with the general feeling of the times, but denoted a sound and commendable policy on the part of the companies.

Five years or so of this enforced policy of economy was at last succeeded by the revival which followed the great iron boom of 1878–79, which set in motion all the collateral industries again, and gave to business an impulse which soon had its effect upon the railway service, in the demand for finer coaches. By the operation of the same healthful force the companies were abundantly able to comply with the popular desire in this respect, and by the aid of inventive genius and liberal expenditure of money were enabled to surpass all former efforts.

Veneering was again discarded and relegated to the past, never more, I venture to predict, to come into general use, as a means of decorating coach interiors. Not that I believe with some that it is a despicable sham or a cheap device, or other species of deception, for I believe it to possess many merits entitling it to a respectful consideration. But it has lived its day; and solid woods are to be preferred instead.

Once in a while you will still see old cars with a veneer finish, and what an antiquated look they have! And now and then one meets with the old-fashioned black walnut finish, with gilt or cream-colored moldings, and similar relics of the former age of car decoration. But mahogany has superseded the black walnut finish, and when put in plain and solid, as it usually is, and made to resemble a mirror in point of luster, the effect is strikingly rich and elegant. The native hardwoods also come in for a share of popular admiration, the beauty of ash being particularly noticeable. In the coaches of the Pennsylvania Railroad, ash is used exclusively for interior construction, and the employment of this wood gives great satisfaction to the traveling public, by reason of the cheerful appearance it imparts to the interior. It also possesses a neat and cleanly appearance, not characteristic of dark woods or painted work.

Accompanying this style of finish should be the unique Eastlake ornamentations in designs and carvings, which are based on the principle that ornaments should not be constructed, but constructions ornamented.

As to the comparative merits of the various materials advocated by some decorators for use in interior finishing, other than natural woods, and some of which have been tried, I would advance as my opinion that nothing will more fully meet with what is required of it, as an article of utility and ornamentation in the finishing of passenger-cars, than these simple natural woods. I am aware that it has been urged against their use that they will darken with age, often assume a dingy, clouded appearance, and generate an impression that the car is soiled and dirty even when perfectly clean. Though admitting that this objection is not without foundation in fact, yet it must be remembered that this fault only exists where the finish has not been properly executed by the painter. For certain it is that the wood will retain its natural beauty of color almost an indefinite period, if skillfully treated. I do not believe that the wood should be surcharged with linseed oil, preparatory to applying the fillers, for the effect is to cloud and blur the original purity of the surface. And the evil deepens as the oil dries, by reason of the chemical changes which it undergoes in the process. Corn-starch fillers, though finding many advocates of their use among the members of this association, are open to the same objection as oil, in that they change and darken, imparting a prematurely old appearance. Now it appears reasonable from the very nature of the case, and the idea is abundantly supported by the weight of experimental research, that a filler having as its base of composition, silica, which is colorless and not subject to atmospherical changes or other influences which operate injuriously upon most other preparations, must be the best adapted to the purpose of closing the pores of the wood, and thereby fitting its surface to receive the coats of varnish, which are to more clearly bring out the delicate lights and shades and veins, and also to protect the wood. When such a filler is employed and the work skillfully and honestly executed, and the best grade of varnish or oil finish, so called, is applied, we may confidently expect a job that will give satisfaction, and be truly a thing of beauty, if not exactly a "joy forever."

By the aid of ingeniously devised machines, these natural woods are beautifully carved and artistically ornamented in the modern styles at a nominal cost, and we are given all the advantages of decorative effect which would follow the use of hand-worked ornamentation. As the builder puts in all this work, the painter's duty consists simply in properly finishing it, and I have already intimated how this should be done.

As to the matter of head-linings, the subject has received some attention at your hands in former conventions, and I should only be traveling over old ground in rehearsing what you have said regarding it. But I may be permitted to recapitulate some of the points which have been drawn out in those discussions, believing that they will prove of interest. At your last annual convention you discussed the comparative merits of muslin and wood for car head-linings. Some favored wood, as it cleaned up better. Some thought it had all the advantages of cloth, while others predicted that paper would become the future head-lining. This latter material was being used with the greatest success, so it was stated. It appeared that the paper linings were grained in imitation of wood and then decorated. It was also said that an elevated road in New York thought of taking out wood linings, as they were not doing well, owing to dampness, which caused the veneers to peel, and also that the expense of the wood was as three to one against cloth or paper.

It is scarcely worth while to debate the question to-day as to the merits of the different materials suggested, as they are all to be superseded, I believe, by another substance (of which I shall make mention further on), which possesses all the merits of the above articles, with an additional feature which must commend its use to every car-shop in the country.

But I wish to say that, in my judgment, no poorer material for a head-lining could probably be found than paper, durability and appropriateness being considered. Besides, such a substance would tend materially to add to the already too combustible nature of passenger-car interiors, which of itself should constitute a cogent reason for its non-adoption for the purpose designated. Nor is muslin or cloth much, if indeed any better, than paper, while veneering should be left severely alone. As for the graining on the paper, it is a species of cheap work that will find no favor among those who despise that form of vulgarity in decorative art, and who look for the true and

beautiful in all things. Last fall, a writer in the *National Car-Builder* suggested that papers, plain and in relief, and in imitations of leather or in the Japanese styles, might "be used in car work in a most striking and beautiful manner." But the idea of decorating a car as one might decorate an apartment in a house, strikes one as being rather an ignoring of the law of place and utility, which should govern in all such cases. We would not like to associate the idea of a decorated room with a coach, as it flies and rattles over the rails, as the impression gained would be a feeling of insecurity and a sense of the violation of the principle of utility in the construction of the vehicle.

It is a pleasure to note that a very important step in the improvement of passenger-cars has just been taken, in the proposition of Mr. George Mann, of Buffalo, N. Y., to make the inside incombustible by using asbestos as an upholstering for seats, materials for curtains, and lining for the entire interior of the car; this to be covered, when used for upholstering or ceilings, with a fine wire cloth on which ornamental designs may be wrought. The adoption of this method will revolutionize the entire system of decoration as now pursued, and render any attempt on our part to outline rules for interior decoration futile. The safety of the passenger being a matter of importance paramount to all others in the construction of the car, it will readily be perceived that the general adoption of Mr. Mann's plan must be simply a question of time, and that passenger-coaches will continue to be models of luxurious ease and artistic elegance no one can doubt, for the public having become so accustomed to their use, they are now regarded as much of a necessity as first-class hotels. Besides, the rivalry existing between the different roads will cause them to furnish the handsomest and most convenient cars for the use of patrons, and will insure a very high standard of service in every other respect.

Undoubtedly the best essay that can be obtained on the subject before us is the personal inspection of the handsome coaches now being put out by the various car-shops of the country, notably by the Pullman Company and the Mann Boudoir Company. The latter company is proving a dangerous rival to the Pullman. It has some cars on the Boston and Albany road that for sumptuousness and general excellence of finish and attention to comfort are not surpassed, if indeed equaled, by those of any other company.

These cars are divided into apartments resembling state-rooms, arranged with high-backed sofas by day, and comfortable sleeping-berths by night. On entering the car at either end, having passed through the vestibule where the porters' and toilet-rooms and buffet are located, a corridor about three feet wide is reached running the entire length of the car on one side. Eight rooms are off from this corridor; five have two, and three four berths each, which extend across the car, the occupant lying with his head toward the corridor. There is ample room for dressing, convenient racks for clothing and baggage, and an electric bell connecting with the porters' room. The ventilation is excellent. A scoop on the top of the car near the front gathers the air, which is forced to pass through a tank capable of holding 600 pounds of ice. Beneath is a pile of excelsior kept wet by the drippings of the melted ice above. The air pouring through the moist excelsior is carried through a flue, extending the entire corridor length of the car, and into the bedrooms by ventilators, and the ventilation is rendered perfect by a ventilator being placed at the top of each boudoir, thus affording an outlet for the air. The walls and floor of the car are packed with granulated cork, shutting off heat and sound. Refreshments may be obtained at the buffet at either end of the car. The cars are 64 feet long and 10 feet wide. Such is the description given by some writer of a magnificent triumph of modern car-building.

The July number of the *Painters' Magazine* gave a description of a parlor-car built by the Pennsylvania Railroad Company at their Altoona shops, and which is only one of a series of similar coaches to be constructed by this company. Its capacity is slightly less than that of a Mann boudoir-car, being 62 feet in length by 9 feet 10 inches wide. The seats are of three kinds, fixed and movable chairs and sofas, 37 seats in all—six in a compartment, similar to the old-time church pews, only they can be divided off by curtains. The smoking-room is large and has 10 seats. The ladies' toilet room is also large, elegantly appointed, and the gentlemen's wash-room is conveniently adapted. A striking feature—and a very original one, by the way—of this car, are the five bay-windows on either side, each 7 feet 4 inches by 2 feet 2 inches wide, with a central window 3 feet wide. Unlike the bay-windows of a house, these windows diverge from a straight line inward, not outward. The car is substantially built, and the general aspect of the interior finish and ornamentation is in marked contrast with old standards. The woodwork is oak, the lower portion—the dado of the car—has a series of very small panels. The ceiling is of one color—a deep Pompeian red—and the whole interior, of lamps, of *repoussé* brass-work, paneling, carving, molding, etc., is skillful and artistic.

In conclusion, I would suggest that the principles which govern decoration as applied to the interiors of our homes may be safely followed in the adornment of railway passenger-coaches. The scheme of decoration should always be in accord with its surroundings and the purposes for which the vehicle is designed. Extravagances of high art should not be indulged in, though the colors and style of ornamentation may be both light and cheerful. Nothing should be attempted that may conflict with good taste. Traveling by rail is not the pleasantest experience in life, and when one is forced to undertake it the trip should be made as endurable as possible, and to this end all our inventive talent in railway industries seems to be directed. Passenger-cars are public educators in decorative art, and we should be careful that the lessons given are not untrue ones.

INVESTIGATION OF ACCIDENTS.

IT is a matter for surprise to an observing person, that there are so many railroad accidents of which the causes are shrouded in mystery, and yet that a careful examination into all the circumstances of one by a Railroad Commission, Board of Trade, or other independent and disinterested body, almost always arrives at a definite conclusion fully explaining why the accident occurred. Perhaps the investigations which oftenest fail to account in a reasonable manner for the occurrences which are the subject of inquiry are those conducted by coroners with the aid of a jury, and those undertaken by the officers of the rail-

road companies. In the case of the coroners the examination is usually under the skillful guidance of an attorney, who has a theory to be established, and who often arranges the facts in accordance with it instead of requiring his theory to conform to the facts. It is within the memory of living men how, in the case of a great washout, the attorneys were so anxious to prove the culvert to have been big enough that they established, in the face of the officers of the road and of a jury which had passed the culvert every day for years, that its opening was 7 ft. in diameter, when in fact it was only 4 ft.

But the reasons why railroad official investigations fail so often are almost as mysterious as the causes of the accidents, for surely the superior authorities should be anxious to learn all the facts concerning them, so as to derive as much benefit in the way of instruction as they may, in compensation for the damage which the disasters have occasioned. We think that the principal reasons are: First, that the higher officials are generally remote from the scene of the accident, and do not often see the results for themselves, only hearing of such details as may be set down for them in a partial report; or, if they do visit the scene of a notable disaster, it is for a few moments only, after things may have been somewhat put in order; and, compelled by more important duties to hurry away, they lose sight of the small particulars which might have proved full of instruction; and, second, that in almost all such events, there are persons concerned who do not wish the exact facts or the true causes to be known, and who are more active to conceal than the investigators are to find out the truth. If there exists upon a railroad any *esprit de corps*, it is shown in the reluctance with which every employé, below the grade of division superintendent, will reveal any circumstance which shows another employé to have been at fault. Of course, when the fault is plain, so that it cannot be concealed, there will be many to prove their zeal by an open denunciation of it; but men who are otherwise trustworthy will keep the inculpating facts to themselves, when it will save their comrades or their subordinates from censure. Even the division superintendent would prefer to have an accident on his division attributed, in the blasphemous language of the law, to an "act of God" rather than to a neglect of man; although he may not be unwilling to know the truth or to admit it when known.

The late lamented Pinkerton, to whom it had happened to inquire into an immense number of accidents at misplaced switches, once told us that the employés and the officials of the railroads almost always believed, or assumed to believe, that such an accident on their road was the deliberate work of an outside miscreant; but that he had rarely failed to prove, after due investigation, that the fault was in the neglect of some person whose duty was connected with the switch, or that it was faulty in construction or in bad order. Indeed, he had almost become convinced, by his numerous experiences of this kind, that a switch accident could not be due to any but an employé.

It is probable that there is no officer in charge of the affairs of any corporation who does not think it would be of value to him to be well informed as to the real causes of any accidents which occur upon his line; there are doubtless many who think they do arrive at them now as a general result, and others who think that it is not worth while to incur any expense after an accident in inquiring about it: "No use to cry for spilt milk!"

We are sure that the confident ones are mistaken unless they have taken more than usual pains; and as to the expense of more careful inquiries after the facts, of course they must cost something, although more in labor and in patience than in money.

The superior results of investigations carried out by the independent bodies of which mention has been made have led us to believe that a fairer spirit is necessary to arrive at the facts than often prevails with those who are generally called upon to report them to the manager of a railroad. It has seemed to the writer that the better results were due chiefly to the entire absence of prejudice or of personal interest with which the detective, or the Railroad Commission or the Board of Trade inspector could enter upon the inquiry; having also advantages which the railroad official has not, as time enough in which to follow each indication, freedom from all responsibility as to how it may turn out, and no previous acquaintance with the persons concerned, which would influence his judgment.

Perhaps something like this impartiality might be secured for the investigations which are undertaken by the railroads for their own information, by the appointment of a *judge advocate* to conduct them, who should have no connection with the operating departments of the road, and no authority except to summon witnesses; with leisure to take as much time as may be necessary, and with orders to report all the facts as he finds them, with his conclusions, to the chief executive officer of the company.

There are many other duties which an intelligent officer of this kind might attend to in the intervals between these examinations, and we conceive that he would be of great service to the executive in making desirable inquiries upon all sorts of economic questions which no chief officer can find time to make for himself.

We do not know of any road which has created an office of the kind we have described, yet we think we know of many upon which it would be extremely useful.—*Railroad Gazette.*

ENGLISH FALLACIES ON THE AMERICAN RAILWAY SYSTEM.

THE world may be going through a commercial revolution the effects of which are felt by mankind, while the causes remain in obscurity, now puzzling the profound and experienced, to come to light in due course, when all will be revealed. No one can point to a general industry which has escaped, and the most industrious of the communities have suffered most. Over-construction, over-production, bad management, dishonesty, etc., are alleged against this or that branch. One nation has been reckless in speculation, another in construction—England building too many ships, America too many railways. Some countries have produced too much corn, some too much sugar, some too much rice, tea, cotton; Manchester has darkened the horizon with its mantle of cottons, Pittsburg has worked up its iron out of proportion to demand. We are told that there is too much of everything. Mark Lane is glutted with wheat, Mincing Lane with all the products of the world. The docks are overflowing with wine, tanks are overflowing with petroleum; everything overflows but buyers. A walk through the city presents empty streets

and offices to let on all sides—above, below, many boards; —the walls are placarded; at every few paces a selling-off shop is passed. What is true of London is true of Paris, of New York; and if true of these capitals, what is the condition of the centers of particular industries, places which live on a trade which seems to have taken unto itself wings and flown away?

Under such circumstances the largest, most industrious and newest of the industries, no matter where placed, would certainly suffer most, unless managed with the utmost caution, and such management cannot be claimed for the railway system of the United States. No other could suffer to a like extent, because no other can compare with it in magnitude—the American network being the vastest, most costly: and doing more business, employing more hands and handling more money than any other national industry anywhere else. The shrinkage would suffice so far as mere figures go, to supply a great country with a railway system. All the rails in Russia, in India, indeed in all Asia, the largest of the continents, might be laid on the sum which represents the decline, and were the rails of American over-construction taken up and bodily transferred they would duplicate every road in Asia and leave a road or two for Persia. As the world has contributed the means, the loss is widely distributed, and the sufferers when they desire something away from home to abuse, can raise a chorus of complaints. The American railway system and management have been attacked right, left, and center; till in Europe the inability of finding any other investment alone prevents crowds from selling out in despair. Some sell first and then come face to face with the question "what to do with the money." India is a country essentially unsafe. The Russian cloud, long gathering on that frontier, is all the more to be dreaded, because the advance is slow. A permanent conquest of India has to be preceded by a deliberate movement onward, step by step; a subjugation of wild tribes, a disciplining of those which are to form the rank and file for the invasion, the incitement being plunder—a great division of spoil. The inroad when it comes will be a root and branch affair, with arms bare and red with blood, and what sort of a chance does the investor stand in a scene of carnage and confiscation? England may organize horde against horde, repel the invasion and roll the tide of war over the Russian conquests, but prudent investors prefer not to take such chances. It is enough that within a generation that war is next to certain. When the investor turns to the colonies he finds all overloaded with debt—all on the borrowing tack, all staving off the day of reckoning by fresh loans, yet money is cheap in the large towns and trade stagnant. Whatever good investments the colonies present are largely appropriated by the colonist, and the British investor gets what the man in the colony with money at command rejects. Glance then at any continental nation; at France about which economists calculate how long the nation can bear her load, when will be the great collapse; will it come in a general commercial panic, or in the smoke of war? What is true of France is true to some extent of every other continental community and over all hangs the insecurity of strife—it may be revolution; it may be nation against nation. Disheartened and weary of the search abroad, on turning back again to look for a safe place for his money, the investor finds little to cheer him at home. His railway securities are at such prices that they yield little more than do consols—nor are they of a class which an American investor would touch, except to sell as a "bear" till he knocked off half. Always growing in capital out of proportion with the increase in property, they seem like the colonial and other governments, to be inevitably if slowly approaching the goal reached by all in the end who spend more than they receive. English railway securities in Wall street, left to find the value a close investigation might reveal, would be torn to shreds. The "bears" would rush in as to a jubilee and dance on them. Their credit would quickly be lost and with it their borrowing power; they would come down by the run to "hard pan," and soon present the appearance—some of them—of cocks stripped of their plumage; and with a good deal of the crow taken out of them. The British investor does not sufficiently realize the difference. He did not understand a somewhat similar position in the case of the National bonds, and the railway case is far more complicated. But let him always keep this fact in mind as the key: Whereas, English railway securities are locked up in English strong boxes—a close borough—American railway securities are afloat on all markets and are the football of the wildest and most reckless "bear" den (Wall street) in the world. This wide scattering helps the operator, so that all the conditions favor the attack. But, asks the investor, what harm can such attacks do if the railway is really sound and well managed? In this age of credit, when the expenditure of costly enterprises is generally in advance of receipts—when even this government has to borrow for current expenses, what would happen if the borrower suddenly lost all power of borrowing, just, too, when he was committed to a large expenditure. Say the Underground Railway with its extension through the city on hand, was by some occurrence deprived of the ability to sell or borrow, what would the position be? All its receipts would perforce go to pay labor and before the works stopped the dividend would vanish. The "bears" on that, point triumphantly to the result, raising the chorus "I told you so." The position is disguised under a cloud of leaders and explanations, meanwhile the broad fact stands out that the line is bankrupt. This has happened in every case in America in which the railway has fallen into the hands of a receiver, while the position is darkened by the lies they tell and by the explanations. To our mind the broad condition is the only simple straight path—the one we can all see and comprehend, and it would be well for those lost in the maze, to get back to first principles and this starting point. The United States comprise the fairest part of the most favored continent. Its transportation is almost all by rail; an increasing fifty-five millions of people use this rail and raise more per head for carriage than other peoples—the transportation, therefore, is prodigious and the system is prodigious. Nothing can be substituted for the rail, so far, at least, as mankind now knows; therefore on this basis rests almost the means of existence of these fifty-five millions so peculiarly well-placed. Yet to draw the inevitable conclusion from the articles which constantly appear in English journals and periodicals, that system, the greatest industrial network ever formed, is only a gigantic fraud—some hole-and-corner patchwork, managed by dishonest and incompetent men. To state the case, is to show its absurdity; but its scope is not generally understood in an island having sea

ports all round, which never can be so dependent on the rail. How then has the whole system fallen into the position it now occupies? Suppose another piece of land, similar to England, but in a state of nature, were added. There would be an immense development, a large expenditure—settlers would rush in, towns be formed, railways constructed; and presently those most active in the work would be selling old securities to supply the means for continuing the construction. Suppose when committed to the work, some cause—a commercial crisis—interposed, stopped sales, demolished credit, and brought down on the heavily weighted, gangs of wreckers whose gain lay in their ruin. Then they would be in the position of those who had begun to build, but could not finish; and it matters not what the earning capacity of the incomplete thing may be when completed; neither an unfinished railway nor a roofless house is a paying concern. It would be urged that all the work accomplished, even in its crude state, was good, was in the line of profitable progress; that the present phase would pass, giving place to renewed activity; that the addition in population and wealth was a material gain to the whole country, etc. But we know by experience that after a set of writers have gone in for a full discussion of anything, only a return to the starting point can extricate the mass from the chaos. We are lost in the details in this explanation and that; but out comes the broad fact that a new county has been added to the island, that all is so much gain, even purchased at the sacrifice of the pioneer workers. And so with the American railway system. As a field for investment it is worth nearly all the world presents besides. It is the rising field; that which yields to the judicious investor the largest return, which places before him the greatest scope, which stands on the most secure basis—the well-being of the most prosperous of all nations; that which no disturbance can materially disturb, and one of the only things which may be said to be safe from the ravages of war, the owners of which cannot be removed or driven out. "Yes," said a British investor to the writer over a year ago, "no more American rails for me; I go into good home securities;" and he went. His good home security is now laid up in the Tyne, where it is likely to lay up for many a long day, and instead of dividends his good home security is calling up all it can scrape out of its ruined clients. Nobody here dreams of saying that the British navigation system is a gigantic fraud, though shipping may at this moment be in a state of depression which would make the American railway system seem prosperous by comparison.—*Anglo-American Times* (London, Eng.)

Petroleum as Fuel.

THE American Consul at Odessa recently made a tour of the Baku petroleum region, and he states that to his surprise he found petroleum used with a steam-jet as fuel on all the locomotives and on the steamers of the Caspian, the Volga and other rivers, and that experiments are in progress to utilize it on the new torpedo-boats now in course of construction at Odessa and at Nicolaeff, for the Russian navy. He says an American introduced the process, having obtained it in Pennsylvania. He says: "The oil is kept in at the stations and fed simultaneously with the water into that portion of the tender (inclosed) usually occupied by coal or wood. The fire in the boiler is started with a coarse, heavy grass, or wood, if near to Tiflis or Baku, until a pressure of about five pounds is obtained, or sufficient to work a steam-jet. The oil is then lighted, a flat jet of steam rushes out and carries the oil-jet to the end of the furnace, producing a strong, hot flame, which is easily regulated by the flow of oil, which is fed in very slowly, only a small quantity being required, and the tank on the top of the tender is sufficiently elevated to allow the oil to reach the furnace by gravity. I watched the apparatus closely, and found that a pressure of steam equal to that produced from a coal fire was maintained, and the absence of cinder and dense smoke made the hot, tedious journey over the Steppe much more agreeable, and at no time was the slightest odor of the oil perceptible in the carriage."

Electric Locomotive Head-lights in Austria.

A RECENT report forwarded from Vienna by Consul-General Weaver, states that recent experiments with Sedlaczek's electric locomotive head-light on the Western Railway have been pronounced by the public prints so successful that he begs to transmit a few items in regard thereto, which may prove of interest to American specialists. He writes:

"The conception of illuminating the railroad track by means of an electric light attached to the head of the locomotive has long since ceased to be a novelty in railway engineering, while the advantages to be derived therefrom, if successfully accomplished, have furnished sufficient spur to urge inventors to the greatest possible researches and endeavors.

"Success, however, has been rendered very difficult from the fact that the oscillations and jars of the engine while in motion soon destroyed the delicate apparatus of the best electric lights known, and that a cheap and convenient method of generating the electric current not immediately dependent on the continuous movement of the locomotive proved difficult to obtain. In 1881 Mr. Sedlaczek, chief of the telegraphic service at Leoben, in Austria, aided by Mr. Schuckert, of Nuremberg, after six years of trial, succeeded in obtaining, it is affirmed, these two great desiderata, first by adopting as generator a Gramme machine with a Brotherhood motor furnished with an automatic regulator, having likewise attached thereto a Schuckert dynamo-electric machine. To obtain sufficient current required from 700 to 800 revolutions of the electric motor, demanding about three horse-power, being less than 2 per cent. of the force of the locomotive; and second, the light was procured by a Sedlaczek lamp, invented specially for the purpose, having a force of 500 carcel jets. The electric machine was placed on the boiler, just behind the smokestack, and brought under the immediate control of the engineer.

"The first experiments took place in September of 1881, between Leoben and Judenburg, on the "Kronprinz-Rudolf Bahn," a distance of 50 kilometers, with great success, it is affirmed; to the end that the road for a kilometer before the locomotive was rendered light as day. The white signals were marvelously brought out upon the black background, and the lamps and lights appeared like yellowish points. The same experiments tried last October between Munich and Diesenhofen, of the Munich-

Salzburg line, resulted in even greater success, as may be seen from the official certificate of the President and Secretary of the commission of experts named by the Munich Electric Exhibition, a copy of whose translation accompanies this communication."

English Comment on American Statistics.

THE annual report of the United States Bureau of Statistics, says the London, (Eng.) *Railway News*, gives some interesting facts, as showing the enormous magnitude of the internal commerce and the consequent field for railroad enterprise. It is shown that the value of the products of the various industries of the United States is seven times the total value of the foreign commerce, nearly three times the total value of the foreign commerce of Great Britain and Ireland, and five times the total value of the foreign commerce of France, including, in each case, both imports and exports. The total value of the products of industry in the United States is also shown to be a little more than twice the total value of the exports of merchandise from all the countries of Europe. The United States is now the largest manufacturing country on the globe. The value of products of American manufactures consumed at home is five times the value of the manufactured products of Great Britain and Ireland exported to all other countries, and more than fourteen times the value of the exports of manufactured products from France to all other countries. The relative value of the internal, as compared with the foreign commerce of the country, is also illustrated by statements showing that 99 per cent. of the coal mined in the country, 95 per cent. of the iron and steel products, 95 per cent. of the products of the leather industry, more than 99 per cent. of the manufactures of wool, 95 per cent. of the products of cotton manufactures, more than 99 per cent. of manufactures of silk, and 97 per cent. of manufactures of glass, glassware, earthenware and stoneware are consumed in the United States.

All-rail Route from England to India.

A PROJECT for establishing a virtually all-rail route from London, England, to Bombay, India, is published. The proposed route is via Tangier, through Morocco, where it would make a junction with the Algerian lines, afterwards continuing by Tunis and Tripoli to Cairo. Thence the line would continue along the Euphrates valley and the shores of the Persian gulf to Kurrachee, the extreme westerly point of the Indian railway system. The cost would be about £10,000,000. Quick trains, three of which would be run weekly each way, would cover the distance between London and Bombay in nine days; while slower trains starting daily would take a day or two longer. The only breaks in this extremely elongated line would be the English channel and the straits of Gibraltar.

Bessemer Steel Works in the United States.

ACCORDING to the *Scientific American* there are 21 Bessemer steel works in the United States, and 2 in process of building. These 21 works contain 46 converters, and 3 converters are building. The total annual capacity of the works completed is 2,490,000 net tons of ingots. The plant building is that of the Benwood Iron Works, at Benwood, W. Va. The States that have Bessemer works are: Massachusetts, one, with two 4 ton converters; New York, one, with two 7 ton converters; Pennsylvania, nine, with twenty-two converters and one building, ranging in size from 2 to 10 ton; West Virginia, one, with two 5 ton converters and one building, which will have two 4 ton converters; Ohio, three, with five converters, ranging in size from 4 to 10 ton; Illinois, four, with nine converters, ranging from 6 to 10 ton; Missouri, one, with two 7 ton converters; Colorado, one, with two 5 ton converters.

The first Bessemer plant in the United States was erected in Troy, N. Y., and made its first blow February 15, 1865; the second was erected at Steelton, Pa., and made its first blow June, 1867; the third was erected in Cleveland, Ohio, which made its first blow October 15, 1868. The largest Bessemer plant in the United States is that at Steelton, Pa., which contains two 7 ton and three 8 ton converters. The next largest are the Edgar Thomson, at Pittsburgh, and the North cago, at Chicago, which have three 10 ton converters. The domestic works are now more than able to supply all domestic demands for Bessemer steel, and one of them recently received a 10,000 ton order from Canada for rails.

British Rail Exports.

FOR November and the eleven months then ending Great Britain has exported rails to the United States and to all countries, in tons of 2,240 lbs.:

To the United States:

	November.			Eleven months.		
	1882.	1883.	1884.	1882.	1883.	1884.
Iron rails.....	....	....	....	21,127	2,593	7
Steel rails.....	4,636	6,702	1,007	167,142	63,579	17,476
Total.....	4,636	6,702	1,007	188,269	66,162	17,483
To all countries:						
Iron rails.....	2,014	1,913	1,305	44,722	23,913	13,836
Steel rails.....	52,292	57,488	33,216	687,416	695,905	493,398
Total.....	64,306	59,401	34,521	732,138	719,818	507,234

The exports to this country were insignificant, as they have been throughout the year. To other countries they were 36 per cent. less than last year and 43 per cent. less than in 1882 in November, and for the eleven months they were 489,751 tons this year, against 653,656 tons last year, 543,869 in 1882, and 391,383 in 1881. Of the entire decrease since 1882, 170,786 tons are in exports to this country, and 54,118 in the exports to other countries. The exports to other countries were much larger this year than in 1881.

The Iron and Steel Trades in Russia.

FOR the purpose of fostering the native metallurgical and engineering industries in Russia, the State has since 1876 offered premiums on the manufacture of such articles as steel rails, locomotives, railway-wagons, &c. The sums received by manufacturers since 1879 are given as follows: 1880, 2,929,051 roubles; 1881, 2,039,515; 1882, 1,034,787; 1883, 748,487, while for 1884 the amount is estimated at 1,950,000. On rails completely manufactured in Russia before May 14, 1885, the Government offers a

premium of 35 copecks per pound (about ⅔ cent per pound). On the rails manufactured only in part in Russia 20 copecks per pound are offered until May 24, and 15 copecks after that date. The aggregate output of the rolling-mills during 1885 is expected to reach 5,080,000 pounds (91,440 net tons).

Railways in the Argentine Republic.

THE Transandine Railway was completed, as has been already announced, as far as Mendoza on May 25 last, and by the end of the year it will probably have reached San Juan, which commands one of the principal passes of the Cordilleras. The Western Argentine line will then be completed. The Northern line is also very advanced, and will shortly reach Salta, close to the Bolivian frontier. The roads of secondary importance are also being vigorously pushed forward, and Buenos Ayres has been connected on the one hand with Santa Fé and on the other with the Northern Railway. The railway-works now in progress in the Argentine Republic are, it is said, occupying more than 10,000 men.

The Fast Locomotive of the Future.

TIME is money, remarks the London *Engineer*, and it may be in the coming years that a demand will arise for a faster means of transit than that which we possess at present. How can we meet it? With our railways laid out with curves and gradients existing, and with our national gauge, and our present type of locomotive, no great advance in speed is very probable: the mean speed of express trains is about fifty miles an hour, and to take an average train of 200 tons weight at this speed over a level line requires between 650 and 700 effective horse power, within the compass of the best engines of the present day. But, if instead of fifty miles an hour, seventy is required, an entirely different state of things obtains. Taking a train of 100 tons, with engine and tender weighing 75 tons, or 175 tons gross, the first question to determine will be the train resistance. With reference to this we want careful experiments. The long and heavy bogie, Pullman and other coaches, have the reputation, rightly or wrongly, of being hard to pull. The resistance of an express train on the Great Western Railway at seventy-five miles an hour was 42 pounds per ton, and taking 40 pounds per ton for seventy miles an hour would give a total resistance on the level of 7,000 pounds, corresponding to 1,400 horse power—about double the average duty of an express engine of the present day. The weight on the driving-wheels required would be 18¾ tons, allowing one-sixth for adhesion. Allowing 2⅛ pounds of coal per horse power per hour would give a total combustion of 3,500 pounds per hour, and to burn this even at the maximum economic rate of 85 pounds per square foot of grate per hour would require a grate area of 41 square feet and about 2,800 square feet of heating surface. Unless a most exceptional construction combined with small wheels is adopted, it appears almost impossible to get this amount on the ordinary gauge.

It is true the Wootten locomotives on the Philadelphia and Reading Railway have fire-boxes with a grate area of as much as 76 square feet, but these boxes extend clean over the wheels, and the heating surface in the tubes is only 982 square feet; but although these engines run at a speed of forty-two miles an hour, they are hardly the type to be adopted for such a service as is being considered.

The whole question of the future introduction of trunk lines, exclusively for fast passenger traffic, is fraught with the highest interest, but it would be foreign to the subject matter of this paper to enter more fully on it, the author merely desiring to state his opinion that if the future trade and wealth of our country require their construction, and if a very high rate of speed much above our present is to be attained, their gauge will have to be seriously considered and settled, not by the reasons which caused the adoption of the present gauge, but by the power required to carry on the traffic—in fact, to adapt the rail to the engine, and not, as at present, the engine to the rail. High speed requires great power, and great power can only be obtained by ample fire-grate area, which, for a steady-running engine means a broad gauge.

Two Points of a Car-wheel.

IT is stated that there is a point of the wheel of a car that touches the rail that does not move forward in the least, and an opposite point that moves forward twice as fast as the car. If the wheel is lifted up and revolved free, the lower point may be said, as to the axis, to move backward with the same speed that the opposite or upper point moves forward. But with the wheel on the ground and rolling bodily forward, this forward motion of the wheel's axis overcomes the backward motion of the lower point, and at the same time carries the upper point forward with double velocity.

THE Board of Railroad and Warehouse Commissioners of Illinois have completed their annual report of the railways in Illinois. The total length of these roads is given at 20,477 miles, of which 5,676 are in Illinois. The aggregate of main lines and branches is 31,059 miles, of which 9,141 miles are in the State. There were 117 miles of new road built in Illinois during the past year. The total amount of stock of these companies is given at $681,127,539, of which $519,136,245 is preferred. The amount held in Illinois is $11,684,450. The aggregate stock and bonded floating debt is $1,346,751,603. Cost of construction and equipment, $255,514,448.

THE success of the Pullman Car Company in its work of building up a model workingmen's city is evidenced by the results of a census of the city of Pullman, Ill., which just been taken. The census shows that the new city now contains 8,329 persons. There are 3,865 men, 1,799 women, and 2,665 children. Several hundred men work in Pullman who reside in Kensington and Roseland. There are now 12,000 people residing within one mile of Hotel Florence. The first family moved to Pullman on January 1, 1881.

FOUR Egyptian youths have entered the locomotive and telegraph department of the Midland Railway in England, with a view to qualifying themselves for railway positions in their own country.

A RAILWAY station recently finished in Birmingham, England, at a cost of two million dollars, is credited with being the largest railway station in the world.

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ANOTHER UNWELCOME VISITATION.

FOR the second time within the brief space of eighteen months the AMERICAN RAILROAD JOURNAL has been visited with a disastrous fire, destroying many valuable records and papers and delaying its issue. The November JOURNAL was on the verge of going to press, already some days behind time on account of a slight delay in obtaining the reports of the Street-Railway Convention, when in a few hours chaos reigned supreme, and the greater part of the work had to be done over again to repair the damage caused by the fire.

To a young publication, just starting on its career, such a catastrophe would doubtless be most discouraging; but the JOURNAL is fifty-four years old and has been used to set-backs. The November JOURNAL was issued with all the rapidity possible, late it is true, but none the worse for the delay. The files of the JOURNAL extending back to the period of the construction of the first hundred miles of railway in this country, and presenting the most complete history in existence of railway progress in America, were fortunately preserved; and we shall continue our task of furnishing the railway world with a monthly magazine and review, undisturbed by the catastrophe, and calmly awaiting a third visitation if Providence so ordains.

Meanwhile we would call attention to the fact that with the current issue, the JOURNAL has published in all since its change in management, thirty contributed articles by well-known writers, and is content to await a verdict as to its usefulness. With the commencement of the year 1885 our energies will be redoubled, and every indication points to an early recognition of the JOURNAL as the literary exponent of the American railway system. There may not, perhaps, be much poetry in railways, but there are a number of vital problems connected with their management that can best be treated in a chatty, discursive and literary fashion, and this the JOURNAL proposes to do, while at the same time omitting nothing from its columns that would be of interest to its large and increasing number of readers.

"CORPORATION JUDGES."

IT is a common practice—much too common it strikes us—to speak of certain members of the judiciary as "corporation judges." The term is either used as a reproach or as a commendation, and in either sense it speaks ill for persons to whom it is applied. A corporation in litigation, is, or should be, recognized as an individual solely, subject to the same restrictions and privileges appertaining to a simple citizen. To suggest that a judge upon the bench lends either a willing or a reluctant ear to the pleadings of a corporation *as a corporation* is an insinuation that either on the one hand he is a friend to aggre-

gated wealth as represented by the corporate interests involved, and unfaithful to the welfare of the people, or else, on the other, that he is permeated with the socialistic theory that corporations have no privileges which are worthy of recognition. In either case we should infer that such a judge was unfit for the proper exercise of judicial functions.

There is a right and wrong to every case, and while different interpretations may be put upon the law by different judges, this difference should not arise through partiality or hostility to corporations as such. Such action must be open to the just charge of corruption or demagogism as the case may be, and so far as the interests of railways are concerned, we deplore the use of terms indicating a judicial bias in one direction or the other. The act of incorporation is a simple act by which generality becomes individuality and there should be no difficulty in applying the same rulings to a railway company as to the single proprietor of a railway if such were to be found; and yet an idea has gained currency that corporative litigation is of a character different from that between two citizens. Indeed lawyers themselves are prone to recognize this distinction, and the very judges are in no ways discomfited if this distinctive character is given to their rulings.

There is the law and there the parties to a suit. It matters little whether the sums involved be great or small, or whether the litigants be single or corporate. The judge has but one clear course open, and that is to interpret the law. If he leans to one side or the other he is unfit for his position.

All this is very trite, and we lay no claim to originality in enunciating these familiar truths, but when we observe certain legal gentlemen suggested for elevation to the judiciary on the ground of their especial usefulness to corporate interests, or opposed on the ground of anti-corporation rulings, it strikes us as time to say a word even if that word has been spoken more than once before. Speaking for railways, we should say that when they enter the courts they should do so for one purpose only—to obtain justice. If they seek favoritism they are pursuing a criminal course. We are aware that in many instances railway speculators desire almost anything but justice, and not infrequently they get what they want, yet we should hesitate to believe that in the abstract, a corrupt or biased judge would be favorably regarded by honestly-managed roads. Nor would such members of the judiciary be useful to railways in the long run. Granted that their rulings might be favorable, and that they might stretch a point or two in behalf of the corporation, there is nothing to hold them to that course. There is no principle back of such action, and if it be prompted by self-interest, the railways will sooner or later pay for it in some manner.

A correspondent has asked us our definition of the term "corporation judge" and it is chiefly in reply thereto that we have spoken as above, Our definition is simple enough and may be summed up in a few words. A "corporation judge" is a member of the judiciary who, through selfish interests or through corrupt influences, lends the weight of his judicial opinions and rulings to the furthering of the schemes of corporations, regardless of justice and the right. That, we opine, is about the size of a "corporation judge."

A NOBLE RECOGNITION OF THE CHRISTMAS SEASON.

IT is gratifying to note that with the advent of the gladsome Christmas season the hearts of railway officials are warmed into love for their fellow-men, and, as usual at this period of the year, we are constantly informed by means of the newspapers that the officers of certain roads have given turkeys and plum puddings to their entire force of employés. Such acts of philanthropy are indeed pleasant to contemplate, and doubtless the appetizing turkey will dwell in the memory of the employé as a grateful reminder of the kindness he has experienced at the hands of his employers; but this year we hear for the first time of an act of genuine benevolence on the part of a Canadian railway official that fills us with unspeakable admiration. The gentleman in question was an ardent disciple of Mr. HENRY BERGH, and even carried his love for animals to such an extent that he became warmly attached to the "iron horse" as the locomotive is poetically called. A few weeks ago, when the question arose as to the usual Christmas donations to the faithful servants of his road, he declared before the Board of Managers that the faithful and uncomplaining locomotives should not be without recognition, and announced his intention of furnishing them with a Christmas banquet at his own expense. In accordance with this generous resolution all the locomotives of his road, numbering forty or more, were drawn up in the round-house at the main terminus, and under the supervision of a force of competent train-hands were treated to a lavish banquet of coal and water.

The impulse which prompted this philocomist to furnish the carbon-hydraulic banquet is worthy of the highest praise; but unfortunately through ignorance as to the exasperating and unreasonable character of the average locomotive, the feast was not an entire success, and certainly was not characterized with the good-will and fellowship which properly appertain to a Christmas banquet. As soon as the locomotives were brought into the banquet hall dissension arose. The highly-polished and cultivated passenger-locomotives refused to hold

any intercourse with the freight-locomotives who, in turn, stung by the slight, looked down contemptuously upon the humble drilling-engines. This clannishness for a time cast a damper over the festivities, but, gradually warmed by the cheerful coals, much of this frigidity disappeared, and all would have terminated pleasantly had it not been for the presence of a few dissipated locomotives, who, obtaining more than their share of the viands became flushed with steam, and highly argumentative and obstreperous. Two locomotives in particular, Nos. 19 and 34, became engaged in a dispute as to their relative capacities for speed, and ultimately this dispute broke up the festivities. At first the two engines contented themselves in bandying epithets and consigning their individual parts to perdition. A few phrases, such as "Smash my Head-light!" and "D——n your Pilot!" passed between them, when, after a peculiarly exasperating taunt made by 34 as to the unsteadiness of 17's wheels, 17 deliberately dealt a stinging blow upon 34's cylinder-head, crushing it in and enveloping the room in a cloud of steam. Instantly the whole assemblage was in an uproar. Raising its connecting-rod, 34 completely demolished 17's cab, and with mingled shrieks and curses the two locomotives, maddened by the fumes of steam, grappled in a deadly embrace. A timid freight-engine, unused to such scenes of carnage, rushed wailing through the side of the building and dashed for the woods. The remaining engines, already overcome with the mellow steam, endeavored to find the rails and retire in good order, and in a few minutes the banquet-hall was deserted by all save the two combatants who with crushed boilers and quivering steam-chests lay expiring upon the floor.

An alarm was sounded and an active search made for the missing locomotives. Several were found in an adjacent ditch groaning with bruises, while others had taken to the woods where they were found entangled in the underbrush, one terrified locomotive having climbed a tree to reach a haven of safety. Several had managed to stick to the rails, and telegrams continued to be received from points along the main line, announcing the arrival and capture of panting and terrified locomotives. They were gradually collected and calmed down, and after a short interval the remains of the two obstreperous engines who had brought about the panic were tenderly removed to the scrap-heap. But it was reluctantly admitted that the Christmas banquet was not a success.

Still, the benevolent official has no reason to regret his generosity. It is by our intentions that we are judged, and certainly no loftier charitable deed can be recorded than the locomotive banquet. Let the giver take heart, and when in years to come, the locomotive having become accustomed to the usages of polite society, this species of banquet forms a regular feature of the railway Christmas, then indeed will he receive his rich reward in the veneration paid him as the Patron Saint of American Locomotives.

EDITORIAL NOTES.

In the confusion attendant upon our recent fire, the November JOURNAL went to press with an error in paging that was not discovered until it was too late to correct it. Instead of the pages being numbered from 225 to 256 inclusive as they should have been, these numbers were passed over, and the pages numbered from 257 to 288. The error having been committed, we shall continue to number the pages of the JOURNAL from the November issue, rejoicing in the fact that at any rate our readers have not been cheated out of the absent thirty-two pages. If at a future time we are asked what these missing pages contained, we can with truth answer: "The contributions that we were unable to find available."

* * *

No one will regret the departure of the year 1884. It has been a year of turmoil and confusion, in which a Presidential election, a financial panic, an earthquake, and a number of lesser disturbances have taken place; and we turn with a wearied sense of relief to rest our shattered nerves in the months of 1885. May it be a more cheerful year in every respect than its predecessor is our heartfelt desire and prayer.

* * *

Regarding railways in particular, 1884 has not been a particularly bright year. When it was scarce two days old the railway world was startled by the announcement of the downfall of one of its greatest magnates, Henry Villard, and ever since it has been a period of receiverships and passed dividends. The construction and opening of new roads have been inconsiderable, and trade generally has been abominably dull. Away with it! Let it be buried in the past as an epoch that affords no satisfaction in retrospect.

* * *

The annual report of the New York, West Shore and Buffalo Railway as made to the Railroad Commissioners of New York State, shows: Capital stock (all paid in), $40,000,000; funded debt, $70,000,000; unfunded debt, $9,339,632; cost of road and equipment, $99,027,121; earnings, $2,979,331; charges against earnings, including $2,604,581 interest, $6,693,360; deficiency for the year, $3,714,029. The road carried 1,360,608 passengers and 839,539 tons of freight. The future career of this singular road will be watched with interest, and the comments on its first official showing since it passed into the hands of a receiver will provoke widely different comment.

Street-Railways.

American Street-Railway Association.

President.—Calvin A. Richards, President Metropolitan Railroad Company, Boston, Mass.

First Vice-President.—Julius S. Walsh, President Citizens' Railway Company, St. Louis, Mo.

Second Vice-President.—Henry M. Watson, President Buffalo Street Railroad Company, Buffalo, N. Y.

Third Vice-President.—Edward Lusher, Secretary and Treasurer Montreal City Passenger Railway Co., Montreal, Canada.

Secretary and Treasurer.—William J. Richardson, Secretary Atlantic Avenue Railroad Company, Brooklyn, N. Y.

Office of the Association, cor. Atlantic and Third Avenues, Brooklyn, N.Y.

The Fourth Annual Convention of the Association will meet in St. Louis, Mo., on October 21st, 1885.

STREET-RAILWAYS AND THE "PROPERTY-OWNER."

THE percentage of street-railways built without vigorous opposition from one quarter or another is very, very small. As a general thing, a road can only acquire an existence and reach the point of active operation after a tedious legal tournament, in which it has had to fight inch by inch for the privilege of laying its rails and running its cars thereon.

If on the face of the globe there chanced to be a civilized country where street-railways were not in general operation—and we have yet to hear of such a country—and if one of the citizens thereof should be asked to state whence he thought this opposition to the construction of street-railways arose, he would undoubtedly reply; "From persons remote from the line, who are naturally anxious to have it constructed in an avenue more convenient for them." Poor deluded stranger! Little would he imagine that the reverse is the case, and that the chief opposition to the construction of a street-railway comes from the property-owners and residents along the proposed line of the road. Strange to say, the people who are to reap the greatest advantages from the road, the people whose property will increase in value through its proximity to a street-railway, are the very people who seek to hamper the project with countless law suits.

It is safe to assume that these same people, after the road has been built, in spite of their unreasonable opposition, will become its chief patrons, and will grumble extensively if their wishes, as residents along the line, are not deferentially considered. They will not deny that the road will be a source of great convenience; that they will patronize it extensively when completed, or that they have frequently been put to considerable difficulty on account of the insufficiency of the street-railway accommodation in their neighborhood; but the simple fact that they are property-owners and thus in a position to bring a suit for injunction restraining the company from laying its tracks, seems to act as an incentive to the exercise of this inestimable privilege. The favorite argument employed by them is to the effect that the proposed road will injure the street. Of all absurd and inconsequential arguments, this ranks deservedly at the front. It is true that there are some narrow streets where the local traffic is so great as to render a street-railway a hindrance to travel, but their name is not legion, and this issue is rarely the one at stake. If the avenue were a mile wide the property-owner would be as rampant as ever. It is equally absurd to claim that the running of street-cars injures the appearance of a street and robs it of its "tone," for a street-car is every whit as handsome an object as a stage or omnibus, and omnibus and stage-lines are not subjected to this legal warfare.

It would really seem that this opposition arises from the fact that the property-owner perceives that certain capitalists seeking a profitable investment for their capital have found it in a street-railway. Of course this is an outrage and the property-owner is righteously indignant. He is perfectly willing to patronize street-railways and will even consent to pay a modest fare thereon, but the owners of the road have no right to expect a return from the money invested, more especially if their road touches the sacred precincts of his property. If the road must be built—and the property-owner is sometimes sufficiently noble and unselfish to admit that the road might be a great convenience to him—very good. He will not stand in the way of its construction—only it must be understood that the stockholders must either buy their franchise at an enormous outlay of capital or else pay a large percentage of the gross receipts of their road into the city's treasury. In either event the amount must be sufficient to preclude all possibility of there being any dividends to the presumptuous stockholders.

In reaching this conclusion as to the animus which prompts the property-owner to oppose the construction of street-railways in streets on which his property fronts, we thought we had solved a great mystery, but after a little reflection we must confess ourselves baffled once more. If this conclusion were correct why should not this opposition also be manifested against the afore-mentioned omnibus and stage-lines? In this connection we might with reason look for even greater opposition, for proprietors of stages and omnibuses are put to far less expense in getting their lines in operation. They have no tracks to construct and keep in repair, and the amount of capital invested is far less than in the case of street-railways. With this fact in view it would be fair to assume that the opposition of the property-owner would be far greater in the case of a stage-line than in that of a street-railway; yet, inconsistent as it may appear, stages are licensed and run through populous streets and avenues without a single word being heard in opposition from the property-owner.

Take it altogether the property-owner, when considered in his relations to street-railways running past his property, is a strange being and he affords a most interesting study. We are tempted to offer a prize for the earliest and most satisfactory answer to the following query: "Why does the property-owner oppose the construction of street-railways that will enhance the value of his property and greatly add to his comfort and convenience?" An acceptable answer to this inquiry would certainly afford us great satisfaction, and relieve our minds from puzzling over a wonderful example of inconsistency.

NOT wholly unexpected, several letters have been received expressing regret at the titular change in this department, and informing us that we were unwise in dropping the word "tramways," which formerly stood at the head of these columns. Like our correspondents, we are not without a feeling of regret at the change, but our regret is of a different character. The American Street-Railway Association, through its officers and executive committee, having requested that the change be made, we were glad to comply with the request, since we regard the Association as the national authority on questions of street-railway expediency, and we do not regret our course. What we do regret is that the word "tramway," superior in every way to its American correlatives of "street-railway," "surface-road" and the like, has not met with general adoption. That we are not alone in this way of thinking is evident from the receipt of the letters in question, and we assure the writers thereof that it will give us great pleasure to reinstate our former titular heading when "tramway" comes into general use. That it will do so we firmly believe, in the same manner as "railway" is fast superseding "railroad;" and sometime in the future we expect "tramway" to receive the endorsement of the American Street-Railway Association. Until that time, however, we shall continue to employ the term "street-railway" exclusively in this department of the JOURNAL, and only give place to these few remarks as a final explanation of our position.

* * *

THE remaining reports of special committees submitted at the recent street-railway convention are printed in full in this issue of the JOURNAL. They are on the subjects of "Stables and Care of Horses," "Electricity as a Motive Power," "The Cable System as a Motive Power," and "A Uniform System of Accounts."

* * *

IN our last issue we erroneously gave the date of the next convention of the American Street-Railway Association as October 14, 1885. The correct date of the fourth annual convention is October 21, 1885, and it will be kept standing in a note heading the columns of this department.

STREET-CAR HEATING.

BY A RETIRED OFFICIAL.

[Written for the AMERICAN RAILROAD JOURNAL.]

DURING the latter years of my active street-railroading days, a period not very far distant, the question of the heating of street-cars in Winter had just become the chief problem for street-railway managers to consider. Cable roads and electric motors were then unknown and street-car heating towered above all other problems demanding a solution. I well remember the argument we street-railway people used to employ to dismiss the subject, and I fear it is still a favorite argument with those managers who are anxious to avoid the introduction of heated cars upon their lines. When "laymen" used to approach us with the query, "Why don't you heat your cars?" we would reply in an off-hand, careless manner: "Pshaw! if we heated our cars the public wouldn't ride in them. They would find them so intolerably close and uncomfortable that they would gladly welcome the return of cold, fresh air." And what is more, we had the hardihood to reply thus while sitting in our comfortable offices and gazing out upon our frost-nipped patrons traveling in cars where the temperature was down in the "teens," and sometimes lower. Since my retirement from active railroading, and since I am now a patron of street-railways myself instead of a grasping official, I have come to think differently, and on cold, frosty mornings, when I am suffering in an ice-box on wheels, I have hurled anathemas at my former self for giving utterance to so silly and baseless an argument. The people *do* want warm street-cars, and sooner or later they will have them.

It has been practically demonstrated that the heating apparatus can be placed in a street-car with such an eye to economy of space that but a single seat is lost. Therefore the argument of lack of space has no foundation. Regarding the question of ventilation I think it is evident that a street-car, both of whose doors are frequently opened while the vehicle is in motion, is subjected to a ventilation that will entirely change the air a dozen times each trip; so I hold the argument of "closeness" to be equally unfounded. It must be remembered that the prevalent desire is not so much for a warm car as it is for a car that is not cold. A temperature of 68 or 70 degrees Fahr., which is generally thought comfortable for an ordinary apartment, would be too warm for a street-car in Winter, where the passengers were warmly clad with overcoats and furs. A mean temperature of from 55 to 60 degrees would be ample, and this can be obtained without subjecting the occupants of seats near the heating apparatus to the slightest inconvenience. Regarding the expense of heating street-cars, it has been clearly demonstrated that it can be done at a cost not exceeding twenty or thirty cents per day for each car, and for even less; so on the grounds of space, comfort and expense no valid arguments can be made against street-car heating.

That there may be other objections, no one will deny. In fact it was not niggardliness nor even economy that prompted us to dismiss the question in my day, but rather a perplexity as to how the heating could be accomplished. The street-car stoves and heaters of those times were very different from the compact little heaters of the present day; but even with the latter I can well

understand that it is a considerable trouble for the conductor to keep the heater in good working order and always at the proper temperature; and before street-car heating becomes universal some other apparatus than a coal-stove must be employed. Considering the brevity of the ordinary round-trip of a street-car, it would seem possible to introduce a very satisfactory system of heat-storage, either by means of hot air, hot water or steam. The supply could be replenished at the end of every trip and the car rendered comfortable in the coldest weather. It would also seem possible to employ the gas-stove as a means of heating, and this would at any rate have the advantage of requiring no looking after. Ordinary gas-stoves, burning eight or ten feet of gas per hour, are sufficient to heat, to the verge of closeness, an ordinary apartment; and a street-car could be kept at a comfortable temperature by means of one at a cost not exceeding two or three cents per hour, or even less, varying with the cost of gas in different localities. It would certainly be an easy matter to store a sufficient quantity of gas in a small gasometer to keep a steady supply on hand in each car.

I do not pretend that any of these suggestions are strikingly novel, for they have probably occured to every progressive street-railway superintendent in the country; and I do not think the latter are to blame for the absence of heated cars. The difficulty, I take it, is not so much that the heating of street-cars is not popular; that it is expensive; that it requires too much room, or even that it is impractical. The trouble is to make the necessary structural change in the car without interruption to travel or injury to the car itself. The question of street-car heating is really a matter more for the car-builders to consider than the company's officers. As a rule, cars are built without reference to a method of heating, and while the expense and trouble of the heating itself may be very slight, the expense and trouble incurred to put the apparatus in position for effective operation is considerable. I have often wondered why the car-builders appeared to give the subject so little attention, leaving the poor street-railway officials to puzzle their brains over the ways and means, when street-car heating is a question directly connected with the structure of the car. If the builders would only exercise their ingenuity and provide cars with a heating apparatus that at once answers all the requirements and possesses the virtue of rapid adjustment for operation, I am confident that the number of heated street-cars would multiply with amazing rapidity. In the end they will have to consider the question, and that builder who enters vigorously into its practical consideration will receive a richly-deserved reward.

In the meantime the public do want heated street-cars, and the various roads are coming to this conclusion. There is no more reason why a street-railway traveler should freeze than a traveler upon a steam-railway, and the question of street-car heating will continue to possess a lively interest until the problem meets with a satisfactory solution. In the case of newly-built roads with new cars, there is certainly no reason why these cars should not be constructed with a view to a system of heating being employed; and when the street-railway companies and the builders are both engaged in the consideration of the vexed problem, we may look for greater results than have yet been reached.

THIRD ANNUAL CONVENTION
OF THE
AMERICAN STREET-RAILWAY ASSOCIATION.

Reports of Special Committees (concluded).

REPORT OF COMMITTEE ON STABLES AND CARE OF HORSES.

THE AMERICAN STREET-RAILWAY ASSOCIATION:—

Gentlemen—The Committee on Stables and Care of Horses, submits the following:

The importance of information upon this subject is shown by the fact that nearly two-fifths of the investment in street-railways is in buildings and horses; and of the expense of operating, upwards of 35 per cent. is consumed in the maintenance of stables and horses.

The care which the horse receives at the hands of the managers of street-railways has much to do with the economy of operating; for it is evident that well-arranged stables, careful attendants, and skillful drivers, with wholesome and sufficient feed go a great way towards prolonging the life and usefulness of the horse in street-car service.

The subject of stables naturally claims attention first, and in this connection it must be understood that, at least, eighteen and, perhaps, twenty hours out of every twenty-four, the horses in this service are confined within the stables year in and year out. Thus three-fourths of the life of the horse is spent in the stable. Considering that plenty of light and pure air are essential to the healthy condition of the horse, to furnish this should be the first object in building a stable.

In selecting material, such should be chosen as will be least likely to absorb and retain the impurities, which will always be found within such buildings. Great care should be taken to have the drainage perfect, and if underground to have the drains so inclined, trapped, and tight in the joints, as to quickly and completely take away whatever is deposited in them. Arrangements should be provided to flush them often with water, and if possible to have all traps and catch-basins well ventilated, so as to carry outside of the stable any foul gases which may accumulate there. The theory of surface drainage for stables has many supporters, and deserves careful consideration from those about to build. If surface-drains are frequently flushed or washed, this manner of draining would seem to call for no objection. The matter of drainage being settled, the next question is light and ventilation.

Arrangements should be made to admit air in sufficient quantity without creating a draught.

Roof ventilation is desirable, but not sufficient, as the air of a stable containing many horses is heavy and will not rise without a current of air from near the floor to assist. Light can be admitted from high openings in the sides of the building, but these should not be depended upon for side-ventilation as the height renders them insufficient to move the air, and the location, usually over the heads of the horses, causes them to be dangerous as means of a draught.

Doors on opposite sides of the stable connected by a passageway running behind the horses, this passageway having ventilation from the roof, is a desirable means of ventilating a stable, as in case the wind blows too strongly in one direction the doors on that side of the building can be closed, while air is admitted from the opposite side.

As a matter of convenience it may be desirable to have all stalls upon the ground floor, but such an arrangement is not practical in large cities on account of the high cost of land, and horses may be as well established on the second or third floor, provided these floors are constructed properly as regards the drainage, and provided with "runs" leading to the outside in two or more directions to be used as escapes in case of fire.

The stalls should be constructed with a view to give the horse as much freedom as possible consistent with economy in utilizing the space. Experience demonstrates that the width should not be less than four feet in the clear, or the depth less than nine feet. The height of the partition between the horses should be at least four feet, and at the heads, carried three or four feet higher, in such a form as to admit light and air without allowing the horses to bite and otherwise annoy each other. Single stalls are preferable, although double stalls, with swing-bars between the horses, are in favor with many good stable-experts. The floor of the stall should pitch toward the gutter about one and a half inches to the nine feet. A good construction for stall-floors is to lay the surface for about four feet inward from the gutter with close-grained hard wood, like maple, in strips of four or five inches wide and two inches thick, leaving a space between, three-quarters of an inch wide, to allow the urine to pass off without being absorbed in the bedding.

The best form of manger or feed-box, is of cast iron, formed so as to have no square corners for feed to accumulate, and of sufficient depth to prevent the horse from "nosing" his feed out. No rack is needed for loose hay; this can be fed in small quantities from the floor. A passageway, say four feet wide, between the heads, or in front of the stalls for the purpose

of feeding is desirable; this should be ventilated by windows or doors at each end, and a flue leading to the roof above. The loft for feed should have a tight floor, so that the steam and ammonia from the stable underneath will not contaminate the provender stored therein. It should be constructed with windows to admit light and air from the sides, and with roof-ventilation at the top. Suitable receptacles should be provided for the manure *outside* the stable, and all refuse and manure should be removed frequently, and before it has had time to heat and steam.

The custom of building stables with cellars to receive the manure is not recommended; and unless there is yard-room enough to pile the manure compactly outside the building, it should be removed from the premises daily. The space allowed for rear floorway between the stalls should be sufficient to permit the removal of horses from one row without interfering with those on the other; for this purpose, ten feet is a fair allowance.

The plan of arranging stalls in sections, so as to have the horses allotted to the care of one man stand together, is a good one; also that of having a separate drinking-trough for his horses. If a common drinking-trough is used, it should be centrally located and supplied with running water.

Twelve feet in the clear is recommended as a good height for each story, although some advise more, and some are content with even less.

Arrangements outside the building to dry and air the bedding are very desirable when straw or hay is used, and if shavings or saw-dust, bins for storage should be provided. If any substance except wood is used for floors, bricks are recommended, as they are easily renewed when worn and less liable to cause the horses to slip than stone, asphalt or cement.

In coming to the subject of the "care of horses," it is suggested that the first care should be exercised in the selection of horses to be purchased. The theory that any kind of a horse that can be had for from $100 to $150 will do for street-railway use, is a bad one.

The buyer of street-railway horses has a somewhat difficult problem to meet from the fact that the horse most desirable to him, usually commands a higher price than he, *i. e.*, the corporation, however, he represents, is willing to pay. A good buyer will always insist upon the necessary qualities in the horse he buys, without too much regard to price. In the first place, only sound horses should be bought. Although horses unsound in some respects, *may* be used to some advantage, it is never best to buy them in that condition, as every railroad manager knows that the exacting labor they are subject to, will cause unsoundness in some form or another soon enough. A good disposition and easy gait should be considered as absolutely necessary. The head and general appearance of the countenance will show the disposition, and a trot of fifty feet, will show the gait. Color should have nothing to do in the selection except to cheapen the price, as is the case with white, grey, buckskin, and bald-faced horses. The feet and muscles of the legs should be carefully looked at, as these are the mainstay of a railroad horse.

A flat-footed horse should never be accepted.

The age should never be less than five or over nine years, as a general rule; a horse of twelve years of age, however, if sound, may be accepted at a considerable reduction in price.

After the horse is selected and placed in the stable, the first thing to do is to accustom him to the feed, and break him to the labor. We would never think of putting on a conductor or driver without first instructing him in the duty expected of him, and place him under the direction of an old hand for practice. This rule should be followed with the horse. The first day he should be allowed to rest. After that if he takes his feed well, he may be put to half-work with a careful driver, and should be worked no more than this. for the first six or eight weeks, at least. All green horses should be given in charge of the best drivers, who will take pains to break them in to the work.

The care of the horse in the stable, includes feeding and grooming. Upon the question of feed, perhaps, the first cost or what is termed "economy" has considerable to do.

It is generally admitted that cut hay and corn meal is the cheapest at first cost, of any feed in use; but experience has shown that this feed is too hearty and fattening, and that horses fed upon it for several years without change become more subject to eruptive diseases and also to colic, inflammation of the stomach and indigestion. It is calculated that at least five cents per day can be saved in this feed on each horse, over the cost of feeding oats and long hay, and that the extra loss on horses fed with meal only, will not amount to the sum saved at the end of the five or six years' service of a railway-horse. To the credit of railway managers it is found that this conclusion is not accepted generally; and that while some are found to strictly adhere to what is termed the natural feed of the horse—oats and long hay—very many compromise the question by giving one such feed daily, or, at least, lighten up the corn meal by mixing bran or wheat middlings, in proportion of about half and half by measure. The mixing or preparing of the feed should be entrusted to as *few* persons as possible; but the practice of each hostler dealing out the feed to the horses allotted to him is not objectionable although many stable experts prefer to confine the hostler's duty simply to watering and grooming the horse and the care of his stall, and to provide one man to distribute the feed to each 100 or 125 horses. In general terms, it should be the care of the stable-master to make the horses under his charge as comfortable as possible, while keeping them in condition to do the work required of them. They should be watered frequently and fed regularly, not less than three feeds a day, and thoroughly groomed not less than twice a day. In warm weather, they should be carefully cooled off after coming in from work, and in cold weather well-blanketed. Disinfectants should be freely used; common lime, either dry or in the form of whitewash, is recommended as effective and inexpensive.

As shoeing is a matter of considerable importance to railway managers it is proper that all entrusted with the care of street-railway horses should inform themselves as to the best form of shoe, and the best manner of setting it. There is but little difference of opinion among the well-informed upon this subject, as to the desirability of a light shoe over a heavy one, and that for horses traveling over a paved street, a shoe made of soft iron is preferable to one made of steel, on account of its being less liable to slip. In all cases the shoe should be fitted to the foot and not the foot to the shoe. On the question of hot or cold fitting, W. H. H. Murray may be quoted. He says: "The weight of authority is nearly the same in either scale. The advocates of cold-fitting declare that they can fit a shoe with rasp and file as evenly as the necessities of the case require, and that this can be done at no great cost of time or skill. They, moreover, charge that both reason and analogy are in opposition to burning a horny surface and declare that it honeycombs the wall of the foot, and prevents its natural and healthy growth.

"The disciples of hot-fitting on the other hand, declare that few men can level the foot, or so hammer and file the shoe, that the fit shall be what is required, and that only by burning can the connection between steel and horn be made sufficiently close and solid."

It must be admitted that good arguments can be used on both sides of this question, but in the end both sides bring up with this fact, that whether by hot or cold-fitting the shoe must be fitted evenly and solidly to the foot. As a matter of interest in this connection, an estimate made by a French professor concerning the muscular fatigue resulting from the use of heavy shoes may be quoted:

"If at the termination of a day's work, we calculate the weight represented by the mass of heavy shoes that a horse is condemned to carry at each step, we arrive at a formidable array of figures, and in this way are able to estimate the amount of force uselessly expended by the animal in raising the shoes that surcharge his feet. The calculation I have made possesses an eloquence that dispenses with very long commentaries.

"Suppose the weight of a shoe is 1,000 grams (about 2 1-5 lbs. avoirdupois). It is not excessive to admit that a horse trots at the rate of one step every second, or sixty steps a minute. In a minute then, the limb of a horse, whose foot carries one kilogram (2 1-5 lbs.) makes an effort necessary to raise kilogram after kilogram, a weight of sixty kilograms (132 lbs.) For the four limbs, this weight in a minute is represented by $60 \times 4 = 240$ kilograms (528 lbs.) For the four feet during an hour, the weight is 14,000 kilograms (30,800 lbs.) and for four hours, the mean duration of a day's work in these omnibuses, the total amount of weight raised has reached the respectable figure of 57,000 kilograms (125,400 lbs.)

"But the movement communicated to these 57,000 kilograms represents an expenditure of power employed by the motor, without any useful result, and as the motor is a living one, this expense of strength represents an exhaustion, or if you like it better, a degree of fatigue proportioned to the effort necessary for its manifestation. This calculation is most simple and readily understood. It is to be noted, nevertheless, that I have omitted a considerable factor, which is, that the weights I have tabulated are situated at the extremities of the limbs and that the arms of the levers on which the muscles act to raise them being infinitely shorter than those of the physiological resistance to which these weights are added, the intensity of their action ought, therefore, to be singularly increased.

"But to measure this intensity of action would require a mathematical aptitude, which I do not possess. I will not, therefore, dwell upon this point, notwithstanding its importance, and am content to signalize it. Otherwise the figures speak for themselves, and tell us that the diminution in the weight of horse-shoes is not an unnecessary consideration, so far as the useful application of the horse's strength goes."

After a careful consideration of the above calculation, must not all admit that the lightest possible shoe consistent with the service, should be used upon street-railway horses?

The question of calking the shoe must be settled by the condition of the street over which the animal travels. Many believe that a calk is not necessary on paved streets, except in the winter season, when ice and snow are liable to interfere; and that if a calk is used at all it should be a low one, so as to raise the frog but slightly from contact with the street, and that care should be taken to have all calks of an even height, to allow the horse to set his foot squarely and evenly upon the ground.

Upon the question of nailing the shoe, a quotation from Fleming seems to "hit the nail on the head." "The shoe ought to be attached by nails to those parts of the wall where the horn is strongest and toughest. In the fore-foot, these parts are in front and along the sides to the quarters. There the horn becomes narrow and thin, and the nails find less support, and are nearer to the living textures. This is more particularly the case towards the heels, especially the inner one.

"In the hind-foot the wall is generally strong toward the quarters and heel. These facts at once give us an indication as to the best position for the nail-holes. In the fore-foot, nails may be driven through the wall around the toe, as far as the inside quarter and a little nearer the heel on the outside. In the hind-foot they may be driven around the toe and even up to the heels with impunity."

Nails should be turned out as quickly as possible, as the higher they go the less thickness of hoof is found, and extreme care should be used not to prick or press the sensitive part of the foot. Too many horses are made almost worthless from the effect of "blind stabs," which means, driving the nail into the quick and then withdrawing it, and driving it again so close to the wound as to irritate it and cause it to suppurate within the foot and work out at the top. Such cases are the result of careless nailing, and frequently terminate in what is called "foot-rot." The difficulty in tracing the exact cause of such trouble, arises from the fact that the horse does not show lameness for one or two days.

As the feet of horses working only on paved streets and standing continuously upon wooden floors are liable to become hard and dry for lack of sufficient moisture, it is necessary that the stable-master should adopt some measure of supplying this need. A simple way and one that can be followed in any stable is to furnish each hostler with a pail and sponge, and require him to wet the fore-feet of all his horses, once or twice a day. The water should be applied particularly to the part where the hair and horn meet, and to the heel and frog. A good idea is to dissolve about a half pint of clean salt in each pailful of water used. This plan should be continued daily, and not occasionally. The stable-master should inspect his horses daily, as to their fitness for work, and "lay off," and nurse any that do not "take their feed," or show lameness.

The next care that the horse requires at the hands of railway managers is that of furnishing suitable *drivers*. The best stabling, grooming, feeding and shoeing cannot counteract the effects of bad driving. Those men whose duty it is to select and educate the drivers on street-cars, should be most faithful and efficient, and no man should be retained as a driver who has not the necessary patience and judgment. Many horses become vicious and balky, by ignorant and careless driving, and a quick-tempered driver is liable to be a costly one.

The last care that comes to us in the treatment of the street-car horses is to select or sort out and dispose of those that have become unfit for the service.

This demands good judgment, for the difference between the price obtained for a worn-out horse and a new one to take the place, is considerable, yet it is folly, and worse than bad judgment, to retain and feed horses unable to work, for it does not take them long to "eat their heads off," as the saying goes. All horses should be disposed of as soon as it appears that their capacity for full railroad service is gone.

This report is submitted with the hope that some hint it may contain, will be useful to the members of this association. This subject is an important one, and to be treated fully, would require more space than the limits of this paper will allow, and demand more talent than this committee lays claim to.

As a conclusion to this report, the personal experiences of two members of this committee, Mr. John E. Brown, Sup't. of the Troy and Lansingburg Railroad, Troy, N. Y., and Mr. T. H. H. Robilland, Sup't of the Montreal City Passenger Railway, Montreal, Canada, are added. Both these gentlemen have had large experience in the care and management of horses, and their views cannot fail to interest this convention.

For the Committee,

J. E. RUGG, *Chairman.*

REPORT OF COMMITTEE ON ELECTRICITY AS A MOTIVE POWER.

The Committee on Electricity as a Motor for Railroad Transportation is not prepared to make a report from personal inspection; but from the information received from different sources, they feel justified in reporting the possibilities of the new system to be very flattering. The experiments made in different places demonstrate beyond question its safety and practicability; and it will not be long before the question of economy will be fully determined by the experiments at Cleveland. In this country and in Europe, there are now several electric railroads in successful operation. The Litchterfelde road, in Berlin, has been for four years a financial success, and the results of the experiments at Coney Island, Menlo Park, and by Messrs. Daft and Edison, at the Mechanics' Fair building at Boston, Mass., have thus far been very satisfactory and encouraging. I herewith submit for your consideration the enclosed communication of Mr. W. H. Knight, of the Brush Electric Company, of Cleveland, Ohio, giving the result of the Cleveland experiment in detail. This letter, coming as it does, direct from the operator of the street-railroad at Cleveland, in response to a request from this committee soliciting such information as would be valuable and interesting to the convention, is really the sum and substance of this report, and contains all the reliable information before this committee.

As chairman of the committee I confess that I have not given to the investigation of this question as much of my attention as its importance demanded; but the unusual pressure of official duties during the last six months has occupied all my time.

ED. C. PETERS, *Chairman.*

BRUSH ELECTRIC COMPANY, CLEVELAND, O., Oct. 8, 1884.

E. C. PETERS, ESQ., *Chairman Committee on Electricity as a Motive Power of the American Street-Railway Association.*

DEAR SIR—Your favor of the 30th ult. is at hand, and contents noted.

The electric railway which we are now operating here is about one mile in length, and at present only one car is run on it. The second car will soon be completed, and the line will then be extended across the railway-tracks to a distance of about one and a half miles. This section, with its two cars, will be operated all Winter without intermission, to demonstrate the "rough and ready" character of the motor, after which the system will be extended over the twenty miles of tramway owned by the East Cleveland company.

Last winter we operated a trial railway, built in the yard of these works; and as it stood the tests of all kinds of weather, we have no doubt in our own minds as to its efficiency the year round.

Briefly the system may be described as follows:

Midway between the rails a conduit eight inches deep is laid flush with the pavement, in the manner of a cable road. Two iron rails serving as conductors are supported within this conduit, and through a slot five-eighths of an inch wide in the top of the conduit, a plow depends from the car, and by means of two brushes makes contact with the conductors. Through this plow the current is conveyed to the motor, which is situated between the wheels under the car, and is tightly boxed up to prevent access of dust, etc. The motor weighs half a ton, and the car is an ordinary two-horse box-car, weighing, exclusive of motor, two tons. The motor is geared to the axles of the car by friction gear and link-belts. The movement is controlled by levers at either end of the car, these levers operating the commutator brushes on the motor to start, stop, or reverse the motor, or to make it go at any speed desired. It has been run at a speed of fifteen miles an hour.

The dynamo supplying the current is located about a mile from the line and is run by the engine used by the company for grinding corn. It is connected to the conductors in the conduit by an over-head line of No. 8 wire. In practice, no over-head line will be used, and a greater economy may be anticipated. The power is sufficient to run two cars, as the engine and dynamo after being started in the morning, runs all day without attention. Only one man is employed to do the firing, and the expense of power, including fireman, coal and oil is about four dollars per day.

With a larger plant, larger and more economical engines, boilers and dynamos would be used, and a much greater econony obtained.

The conduit will cost from five to seven thousand dollars a mile when made of steel, and it ought to last a lifetime. To equip an ordinary two-horse car will cost in the neighborhood of $1,500, and the power at the central station for each such car will be in the neighborhood of $1,200. Each car will pull another car of the same size.

The steepest grade we have experimented with is 500 feet to the mile, and no difficulty was found in overcoming it.

The conduit is kept free from dirt, snow, etc., by a brush depending from the car through the slot. Catch-basins are placed at intervals varying from 50 to 100 feet, and where possible a sewer connection is made.

The system is similar to a cable road in that it requires a conduit and a central power station; but it differs in every other respect.

It may be operated on single-tracks as well as on double-tracks; and branches may run out from the main road in every conceivable manner. Any speed may be assumed at the will of the operator without wear of machinery. Ordinary car-drivers can operate it after five minutes' instruction. Stoppages can be made quickly by reversing the motor. Running off the track does not injure the machinery, and a flexible connection on every car enables the motor to run the car back on to the track when the lever is reversed. A much smaller conduit can be used than with cables, and there is no machinery along the line. The conductors cost but $200 a mile, and the wear of the brushes upon them seems to be *nil.*

We use a high tension current because our investigations have showed us that when distances greater than one or two miles are to be overcome, no other current will give the necessary economy. The conductors are, however, inaccessible, and no danger is anticipated. We are ready to equip any road not exceeding twenty-five miles in length.

Hoping I have touched upon the main points of interest,

I am, very truly yours,

W. H. KNIGHT.

REPORT OF COMMITTEE ON THE CABLE SYSTEM AS A MOTIVE POWER.

THE AMERICAN STREET-RAILWAY ASSOCIATION:—

Gentlemen—So completely has the country been flooded with literature pertaining to "The Cable System of Motive Power," that the writer of this report has no hope of offering any new facts; but since the system has

acquired such magnitude and prospects, it may be fitting that the archives of the association should possess some brief record of its beginning and progress.

Climbing the steep hills of San Francisco, the fertile genius of Mr. A. S. Hallidie conceived the idea that transportation, which could not be accomplished by animal power, might be by endless ropes; and to him and his associates, all credit is due for the first successful construction and operation of the system, eleven years ago.

What seems so easy and natural in the retrospect, lay before those men an untried, and, in the opinion of many, a foolhardy undertaking. The money invested was regarded as squandered, and the whole scheme a trifling with the impossible. But through innumerable difficulties and trials, they persevered, until intelligent experiment and dauntless courage wrought success. Clay Street Hill became world renowned for its novel and ingenious railway, the advantages of which soon caused parallel lines on steep grades to be constructed on Sutter Street, California Street, Geary Street, Union Street, and recently one on the more level line of Market Street and its branches.

After the first four lines had been built, covering short distances and carrying few people, a road was constructed in Chicago in 1881. The latter city claims not one iota of credit for the invention of the cable system, but did undertake the somewhat serious task of demonstrating

First: That the system could be utilized in a region of harsh Winters, deep snow and frost, the antipodes of the balmy climate and perpetual Summer of California, and,

Second: That it could be expanded into a suitable system for moving the vast population of our largest cities.

The former could not be accomplished by any fragile construction but required great strength and compactness to resist the strains inevitable in a large commercial city, and the powerful pressure of the frost in a Northern Winter. The latter could not be accomplished by any mile, or mile and a half, of timid trying; but with unshaken faith in its method of construction and the possibilities of the system, twenty miles of track were constructed, and the daily transportation of 100,000 people attained, with the ability to move five times as many.

In addition to the lines indicated above, cars have been moved by cable for fifteen months over the New York and Brooklyn Bridge; an extensive system is building in Philadelphia; a line in New York, one in Kansas City, and one in Hoboken, and comprehensive systems have been proposed for New York and Brooklyn. Recently under the superintendence of American engineers this purely American system has been introduced and short lines constructed in London, Eng., South Wales and New Zealand.

The construction consists of an underground tube through which the cable passes (supported by grooved pulleys,) in constant motion and at uniform rate of speed. The tube is provided with sewer connections for drainage, and an open slot on the top, through which passes a gripping device which is attached to a car. The cable is kept in motion, and its speed regulated by a stationary engine or engines. The rope is endless and the splices must possess great strength, but not increase the diameter of the rope, as any enlargement would incur severe and dangerous abrasion. It should be coated with pine tar and lubricated with linseed oil to protect it from rust and the too harsh action of the grips. The drums which impart motion to the cable, and the sheaves which carry it around sharp corners, should have a diameter about one hundred times the diameter of the rope. Of what material the rope should be made to secure the best returns is a question of great importance, affected by climate, the rate of speed it is to run, the frequency of stopping and starting, the character of the gripping device, and the manner of applying the same, and the hilly or level character of the road. In cases of sharp deflections from a level, pulleys are required to depress the rope, and as these must be small to allow the grip to pass below them, the wear upon the cable is serious. To meet these conditions, flexibility and toughness, combined with strength and freedom from crystalization are needed.

Another important feature in a cable system is the device for automatically securing the proper tension of the rope. The extent of vibration will depend on its length, amounting in one four miles long, to some five feet, and is caused by the sudden grappling of the cable by a heavily loaded train. As the rope settles some two and a half inches between every two carrying pulleys over the entire road, the sudden tightening and stretching of the cable produces an accumulation. If this were not instantly taken care of, the rope would drop from the carrying pulleys and sheaves and be destroyed; also violent surgings of the trains would ensue. Were the rope to be drawn so rigidly as to prevent this settling, the intense strain would soon destroy the cable and the operating machinery. Provision is also made in this device for taking care of the permanent stretch of the cable amounting sometimes to two hundred feet.

The gripping attachment should be prompt and positive in its action, and, in the most successful forms yet devised, consists of an upper and lower jaw, between which, the cable is seized by the movement of a lever, one pound of pressure on the handle of which produces four hundred pounds pressure on the cable. A small sheave is placed at each end of the jaw, upon which the cable rides while the car is standing. Provision is also made for throwing the cable out of the grip and entirely free from it at any time or place. Exigencies may arise when this is of the utmost importance. The length of the grip is such that it passes some three inches above the carrying pulleys and does not come in contact with them. The cable is brought into the open jaws by an elevating sheave placed at an angle on one side of the tube. The metal used for lining the grip performs 2,000 miles of service, when it requires renewal.

In Chicago a speed of eight and a half miles an hour is attained over one half the lines, and nine and one-half miles over the other half; except in a few places where the speed is one half the above rates and can be made as much less at any point as may be desired. To operate at this speed with safety, the cars are provided with ample guards which prevent any one from falling under the wheels, and powerful brakes can be applied to every wheel in the entire train by the easy movement of a lever in the hands of the driver.

The system possesses special advantages in heavy snow-storms, as the power is not derived from friction on the rail, but the appliances for clearing and sweeping the track are drawn swiftly and at short intervals by an untiring power. More power is required during a snow-storm, but in ordinary conditions, the operation of twenty and one-fourth miles of cable in Chicago has required 477 horse-power; of this 389 was used in moving machinery and cables, and 88 to move the 240 cars and their passengers. The cable and its coating weighs about 270,000 pounds, and is doing work which would require 2,500 horses.

In hilly sections where horses and locomotives would be useless for the purpose, the cable system can move cars as quickly and swiftly as on a level road; and on level roads it is found to be only one-half as expensive in operation as the ordinary horse-railway system, while its capacity for moving vast numbers of people is practically unlimited. It is the only system yet devised, which satisfactorily meets the uneven pressure for transportation with the least possible increase in expense. No difficulty is experienced in turning corners, either with main cables or auxiliaries.

As regards humanity for horses and consideration for the nerves of passengers, it commends itself to all. In point of cleanliness, a system which saves the use of thousands of animals in a city is of great sanitary value, and the comparative quietness of its operations is highly appreciated by those who reside beside it.

The speed at which it runs, and the quickness and ease with which it starts and stops adds to the comfort and well-being of its patrons; and when equipped with the present safeguards and appliances, is found to be far more safe to the general public than the ordinary horse-car. It has no will of its own to thwart the will and efforts of the faithful driver.

The increase in the value of real estate along the street where it operates, and on parallel and cross streets for several blocks each way, is many times the cost of its construction, being from 50 to 200 per cent. in a single year.

The cost of construction is much greater than that of an ordinary tramway, but the economy of operation far outweighs this objection, as it saves more than the interest on the increased cost.

In Chicago, the cost was perhaps greater than would be necessary in most cities, owing to the nature of the ground, reaching $105,000 per mile of single track. Too much stress cannot, however, be laid upon the importance, *the absolute necessity*, of a substantial and durable structure which will not be broken or displaced by heavy trucks or by the pitiless frost. If all the parts and appliances are well and permanently built with ample safeties in point of strength, and vigilance attends its operation, it will prove a great and unalloyed blessing to any city, and bring satisfaction and recompense to its owners.

The limits of this report will not allow allusion to the manifold improvements made and making in many quarters, in its construction and appliances, but what has been accomplished in so short a time is ample guarantee that vast good is yet to come from "The Cable System as a Motive Power." In behalf of your committee, this report is respectfully submitted.

C. B. HOLMES,
Chairman.

CHICAGO, October 15th, 1884.

REPORT OF COMMITTEE ON A UNIFORM SYSTEM OF ACCOUNTS.

The American Street-Railway Association:

GENTLEMEN—The committee appointed on "A Uniform System of Accounts," is of the opinion that what is wanted is "A Uniform System of *Operating Expense* Accounts," rather than a Uniform System of General Accounts of Assets and Liabilities.

A circular was issued by the chairman of this committee to the several street-railroad companies belonging to this association, asking for a list of accounts kept by their respective companies. The chairman wishes to report that the responses were promptly received from nearly every company in the association, showing that a great and general interest is felt in this matter. The information is gathered that there is a great diversity in the methods of keeping accounts, and it is certainly very evident that a uniform system of keeping operating expense accounts would result in very great good, not only for the opportunity it would afford for comparisons, but it

might possibly furnish information which would result in savings to many companies.

Your committee takes pleasure in presenting the system now in use by the Louisville City Railway Company, and of recommending and offering the same for your consideration and discussion.

The operating expense accounts kept by that company are as follows:

No. 1. Conducting transportation.
No. 2. Motive power.
No. 3. Maintenance of way.
No. 4. Maintenance of cars.
No. 5. General expense.

Under these general headings are kept several sub-accounts, as shown in the accompanying form kindly furnished by the Louisville City Railway Company, and which is herewith presented by your committee as part of this report. The form may be modified to suit the different companies.

Respectfully,
E. K. STEWART, *Chairman.*

Sub-Divisions of Operating Expense Accounts, and of Construction, Equipment and Improvement Accounts.

1. CONDUCTING TRANSPORTATION.

1. Supervisors, Inspectors and Starters—Labor: Starting cars, supervising the running of cars, and overseeing and keeping time of conductors and drivers.
2. Receivers and Clerks—Labor: Receiving and reporting fares paid to conductors, putting up and selling change, and handling fare boxes.
3. Conductors—Labor: Conductors' wages.
4. Conductors' Extra Pay—Conditional percentage on conductors' earnings.
5. Switchmen, Flagmen, etc —Labor: Switching, flagging and pushing, curve men, turntable men, gatekeepers, and driver of advertising car.
6. Car and Lamp-cleaners and Watchmen—Labor: Lampman, car and lamp-cleaners, and watchmen at car houses.
7. Lighting, Oiling and Cleaning Cars—Oil, matches, etc., for lighting; oil, brooms, brushes, rags, sponge, etc., for oiling and cleaning, and straw used in cars.
8. Stationery, etc.—Envelopes, slips, cards, notices, bill-boards, paste, school tickets, and employés' passes.
9. Registers and Punches—Expense incident to use of same.
10. Furniture and Implements—In car-houses and receiver's and starter's offices, including money satchels, boxes and carts, and repairs of same.
11. Car License—Payable to City.
12. Loss from Accidents—Legal, medical and other expense growing out of injuries to persons and property.
13. Fuel, Light and Water—Used in car-houses and receiver's and starter's offices.
14. Car-Houses and Office Repairs—Labor: Repairing, whitewashing, and cleaning car-houses and receiver's and starter's offices.
15. Car-House and Office Repairs—Materials, etc. used, and other expense of same not charged in No. 14.

2. MOTIVE POWER.

16. Animals—Cost of animals, and expense incident to purchasing same.
17. Care of Animals—Salt, medicines, etc., and other expense not charged in Nos. 16 and 18.
18. Stable Men—Labor: Foremen, hostlers, surgeon and watchmen.
19. Forage—Cost of same, including freight.
20. Handling Forage—Labor: Hauling, weighing, storing, cutting, grinding, and otherwise handling and preparing food.
21. Stable Tools, Implements and Machinery—Groomers, extinguishers, and all stable tools and machines, and repairs of same, not charged in No. 24.
22. Feed-mill, Implements and Machinery—Machinery and implements used in handling food, wagon license, inspecting scales, and all repairs not charged in No. 24.
23. Blacksmiths' Tools—Including material used, and other expense of making and repairing not charged in No. 24.
24. Shoeing Animals, etc.—Labor: Shoeing animals and repairing machinery, tools, etc., in stables and harness and smith-shops.
25. Shoes and Nails—Including material used, and freight on shoes, nails and material.
26. Harness and Repairs—Labor: Making and repairing harness.
27. Harness and Repairs—Material and tools used in harness-shop, and other expense of making and repairing not charged in No. 24.
28. Furniture and Repairs—Elevator, stoves, clocks, etc., in stables and smith and harness-shops.
29. Fuel, Light and Water—Used in stables and smith-shops, including cost of wells and pumps on premises.
30. Drivers—Labor: Drivers' wages.
31. Drivers' Extra Pay—Conditional percentage on drivers' earnings.
32. Stable and Smith-Shop Repairs—Labor: Repairing, whitewashing and cleaning stables, smith-shops, wells, pumps, fences, and yards adjoining.
33. Stable and Smith-Shop Repairs—Material used and expense incurred, not charged in No. 32.

3. MAINTENANCE OF WAY.

34. Track Repairers—Labor: Supervisor, foremen, teamsters and laborers on track and turntables.
35. Track Repairs—Cost of wood material used, including freight and work done on same, not charged in No. 34.
36. Track Repairs—Cost of iron material used, including freight and work done on same, not charged in No. 34.
37. Track Repairs—Water, rock, gravel and other expense not elsewhere charged.
38. Track Cleaners—Labor: Removing obstructions from track.
39. Cleaning Track—Salt, residuum, oil, etc., used for this purpose, and expense of removing obstructions from track.
40. Road Tools and Implements—Including plows and scrapers, road-wagons and carts, license on same, and repairs not charged in No. 41.
41. Road Tools and Implements—Labor: Making and repairing all tools, implements, vehicles, etc., used on road.
42. Incidental Road Expenses—Any expense incident to maintenance of way not chargeable to other sub-accounts.

4. MAINTENANCE OF CARS.

43. Car Repairers—Labor: Repairing cars.
44. Car Repairs—Cost of material used, and other expense not charged in No. 43.
45. Car Furniture and Repairs—Fare boxes, poles, racks, signs, single and double trees, curtains, lamps, chimneys, etc., and repairs not charged in No. 46.
46. Car Furniture and Repairs—Labor: Making and repairing any of same.
47. Shop Tools and Machinery—Machinery, tools and furniture, used in car and paint-shops, and expense making and repairing not charged in No. 48.
48. Repairing Tools and Machinery—Labor: Making and repairing same.
49. Furniture and Repairs—Used in car and paint-shops.
50. Fuel, Light and Water—Used in car and paint-shops.
51. Repairing Car and Paint-shops—Labor: Repairing, whitewashing, and cleaning shops and premises.
52. Repairing Car and Paint-shops—Material used, and other expense not charged in No. 51.

5. GENERAL EXPENSE.

53. Salaries of General Officers—President, vice-president, directors, secretary, treasurer and superintendent.
54. Expenses of General Officers—Traveling and other expense on company business not chargeable to other sub-accounts.
55. Salaries of Clerks—In offices of superintendent, secretary and treasurer.
56. Office Expenses—Fuel, light, water, ice, postage, telegrams, wages of janitor, etc.
57. Stationery and Printing—Books, maps, blanks, stationery, printing, advertising, and other like expense, not chargeable to No. 8.
58. Telephone Service—Cost of same, and repairs of office telephone.
59. Furniture and Repairs—Safes, counters, desks, chairs, clocks, money-scales, awnings, etc.
60. Office Repairs—Labor: Repairing general offices.
61. Office Repairs—Material used, and other expense not charged in No. 60.
62. Interest, Discount and Exchange—Including expense of paying coupons.
63. Sprinkling—Sprinkling street in vicinity of general offices.
64. Rents—On buildings and ground.
65. Taxes—Payable to City and State.
66. Insurance—Premiums on same.
67. Legal Expenses—Attorneys' and clerks' fees, copies of court records, city ordinances, etc., not chargeable to No. 12.
68. Detective Service—Any expense of this character.
69. Real Estate Expenses—Surveyors' fees and any expense incident to purchase and sale of real estate.
70. Gratuities—Rebates of fares, and donations of every kind.

CONSTRUCTION, EQUIPMENT AND IMPROVEMENT ACCOUNTS.

71. Cars—Labor: Building new cars.
72. Cars—Material used, and other expense of building new cars not charged in No. 71.
73. Track—Labor: Constructing new track.
74. Track—Material used and other expense of constructing new track not charged in No. 73.
75. Buildings and Improvements—Labor: On new buildings, sheds, etc.
76. Buildings and Improvements—Material used, and other expense of new buildings and improvements not charged in No. 75.

Use of Iron Sleepers on Street-Railways.

A RECENT issue of *Le Génie Civil* contains some observations concerning the use of iron sleepers on the street-railways of Paris. The roads were first introduced into France by M. Loubat in the year 1852, but made little progress until 1873, when concessions were obtained for the construction of sixty-four miles (103,500 m.) of lines in Paris. This concession was divided into three systems, which were allotted respectively to the Compagnie Générale des Omnibus, the Compagnie des Tramways-Nord, and the Compagnie des Tramways-Sud. The ordinary grooved tram-rail, spiked to a longitudinal timber sleeper, was first adopted. The weight of rails used at first was thirty-eight pounds per yard, which rails were found to last ten years; but a forty-six pound rail was subsequently introduced, which was estimated to have a life of twenty years. The Compagnie des Omnibus have since and up to the present time used a grooved rail of about the same weight (forty to forty-eight pounds per yard), fastened to a longitudinal sleeper by a countersunk bolt passing through the bottom of the groove. In this system it is found that the holes bored vertically through the sleeper permit the infiltration of water and hasten the decay of the timber and loosening of the bolts. The company are now making trial of a system introduced by M. Massillon, which has been in use some time on the Lille roads, consisting of an ordinary bridge-rail and counter-rail of light section bolted to an iron longitudinal sleeper. This system, from the absence of timber, forms a more durable road, but is much less elastic under the passage of wheels than the older modes of construction. It is found that that the counter-rail should have the same section as the rail, in order that it may stand the wear and tear of the ordinary road traffic.

Danchell's Electric Railway.

THERE is on exhibition at the Westminster Aquarium, says *Engineering*, a working model of a new electric railway for which very considerable advantages are claimed by the inventor, Mr. Danchell. The feature which distinguishes it from previous attempts of the same kind is that the locomotive and vehicles run between a pair of rails placed vertically one over the other, the lower carrying the weight and the upper serving as a guide to prevent the vehicles from falling over sideways, and also, in some instances, increasing the adhesion of the locomotive. Each vehicle has two wheels, one before the other. These wheels are not flanged, but are kept on the track by eight guide rollers, two running against each side of the upper rail and two against each side of the lower rail. The electric motor carries on its spindle a small friction pulley situated between the two driving-wheels of the locomotive. These wheels are carried in sliding bearings and can be set up to obtain a sufficient pressure against the friction pulley, so that the rotation of the motor is imparted to them. For lines with steep gradients, a small wheel is fixed over each driving-wheel in such a way that it has a constant tendency to jam itself between the wheel and the upper rail and thus increase the adhesion of the locomotive. The rails act as the conductors for the current, which enters the motor from one of them and leaves it by the other. It is claimed for this railway that it will run with very small friction, and that exceedingly high speeds are possible without danger, but it is difficult to find any argument for putting an electric locomotive on a single rail which is not equally applicable to a steam locomotive, while the safeguard afforded by an overhead rail is as available with one kind of carriage as another. An engineer who put forward such a plan with any existing form of traction would expose himself to derision, and we fail to see that the use of electricity as a propelling power alters the conditions of stability under which a railway works. As to the electrical part of the scheme it appears devoid of novelty, and whatever advantages exist in the Danchell railway are to be found in the use of a single track and a steadying overhead rail.

Underground Cable Railways.

AN exchange remarks that an important advance in the development of cable roads is to be noted in the approval by the British Parliament of a scheme for constructing an underground railway to be operated by cable in the city of London. This road is to run from a point in King William Street, where it connects with the present underground railway system of that city, to St. George's Church in Southwark, the converging point of the present southern system of tramways terminating at the "Elephant Castle," about 1.25 miles. Each of the two lines will be in a separate tube ten feet in diameter. A space of thirty cubic feet per passenger will be given in the cars, which is ten more than is required by the Board of Trade. The diameter is five feet less than would be required if locomotives were used. The cable will be run at a uniform speed of ten miles per hour and is to be worked by hydraulic power—no steam being used. The cars will hold fifty passengers, and will run every two minutes during the eight busiest hours of the day. The charge for the entire distance is to be one penny, so that the gross receipts for a fully-loaded car will be less than $1. The total estimated cost of the line, including equipment is about $1,175,000 (£235,000), on which an average of half-loaded cars throughout the year would pay ten per cent. annually, exclusive of the estimated cost of maintenance, repairs, etc. The progress of the enterprise will be watched with much interest.

A Railway Run by Water.

AN English exchange describes a railway at Falcon Cliff Castle, Isle of Man, some particulars of which may be interesting. The railway consists of an up and down line of the ordinary four-foot gauge, running parallel for about fifty yards on a gradient of about one in three. The vehicles, two tramway cars, are moved by water poured into an iron tank upon which each car rests; and the running is controlled by a stationary hand brake. The tank is of an angular shape and rests upon four wheels of the usual railway coach pattern, with a single flange on the tire. The shape of the tank necessitates two of the wheels being placed lower than the other two, while the body of the car resting on the horizontal line of the angle, admits of it preserving a perfect level although running on so enormously steep an incline. A cable, permanently affixed at each end to the cars, runs in the center of the four-foot

track and around a wheel about six feet in diameter, stationed at the top of the gradient, the other upon the parallel pair of rails being at the bottom. The tanks upon which the cars are fixed are fed with water at the top of the incline and emptied at the bottom, the weight of the water in the filled tank being sufficient to sink this car to the bottom of the gradient and at the same time by means of the attached cable to draw up the car and passengers resting upon the empty tank. The mechanism for filling the tanks can be worked by the same man who has charge of the brake of the wheels upon which the cable revolves, and by means of which the speed of the running of the cars is controlled.

Street-Railway Earnings.

THE following yearly reports have been filed with the Railroad Commissioners of New York State, to Sept. 30, 1884: The New York and Harlem Railroad—Receipts from passengers, $751,928.95; haulage of cars, $54,600.75; rents, $42,477.17; miscellaneous, $4,533.51; total receipts, $853,540.38. Payments—Transportation expenses and repairs, $544,838.69; interest, $14,098; dividends, $189,000; State tax on capital stock, $4,725; on gross earnings, $3,972.09; total payments, $756,633.78. There were four persons killed during the year and six injured. The Broadway and Seventh Avenue Railroad: From passengers, $888,555.83; from interest, sales of materials, etc., $32,992.24; total receipts, $921,548.07. Payments—Transportation expenses, $638,943.93; interest, $117,956.26; dividends, 8 per cent., $168,000; total payments, $924,900.19. Three persons were killed and five persons injured during the year.

The Future of Electricity.

EDISON, the inventor, indulges in the following prediction: "As to the changes which will be effected by electricity within fifty years in the city of New York, I would say that I believe electricity will propel the cars of the street and elevated railroads, light the city within and without its buildings, furnish power for all purposes, work telephones and burglar alarms, deliver the opera, convey parcels, detect and signal fires, operate fire-engines, and possibly displace animal locomotion for vehicles."

Of Course He Would.

THE last seat in the horse-car had just been taken, when a very pompous, nervous old gentleman boarded it and casting his eye around in search of a place in which to deposit himself, discovered that a little boy occupied the corner seat at the further end. The old gentleman evidently made up his mind to have the corner seat, and, approaching the youngster, he said: "My good little boy, you are younger than I am and can stand the strain upon your legs better than I can, for I have so much more to hold up. Won't you, like a good little boy, give me your seat?" "Naw," said the boy, stoutly gazing at the old gentlemen. "You should be more polite, my boy, and more obliging. You know that if your father should come in now and ask you for your seat you would give it to him." "You betcher life I would," answered the boy in a truly obliging spirit, "'cause I wouldn't ride in no car wid no ghost."—*Exchange.*

Proper Distinctions.

"WILL you pull the bell?" she asked of a man across the aisle as the car reached the corner. "No, madam," he answered with a bow; "but I will be most happy to pull the strap which rings the bell." "Ah! but never mind! The strap is connected with two bells, and you might stop the wrong end of the car!" And the look she turned upon him was full of triumph veneered with cayenne pepper.—*Detroit Free Press.*

Force of Habit.

"How old is your little boy?" asked Mr. Smith.

"He is just six."

"No I ain't," interposed the little boy, "I'm eight."

"Why, so you are—of course, what am I thinking about?"

"I guess you must be thinking about the street-car conductor, pa."—*Exchauge.*

STREET-RAILWAY NOTES.

THE elevated railroad companies of New York, in the year ending Sept. 30, 1884, carried 96,702,620 passengers, and the gross receipts of the companies were $6,726,359.30. Since the opening of the original line, the New York Elevated Railroad, on September 30, 1872, to September 30 of this year, the total number of passengers carried by the several lines aggregated 474,465,558, and the aggregate gross receipts were $34,075,637.70. There has been an increase of over 100 per cent. in the number of passengers carried since September 30, 1879, without any extension of the railroad lines.

THE capital stock of the Greenpoint (L. I.) and Lorimer Street Railroad Company, which has filed its articles of incorporation, is placed at $120,000. The proposed road is to run through Broadway to Fifth street, to Division avenue, to Lee avenue, to Gwinnett street, to Broadway, to Lorimer street, to Van Cott avenue, to Manhattan, to Meserole, to Franklin street, to Greenpoint avenue, and thence to the Tenth and Twenty-third street ferries.

THE South Bend (Ind.) and Mishawka Street-Railway Company, which has a capital of $100,000, has filed articles of incorporation. The directors of the company are Edward B. Dikeman, Perley H. Brown, Jeremiah W. Boynton, J. H. Knight and John Lyons.

IN the department of new inventions this month is published the description of a street-railway rail-joint recently patented by a valued contributor to the JOURNAL, Mr. Augustine W. Wright, superintendent of track construction of the North Chicago (Ill.) City Railroad.

THE city of New York has just received from the elevated roads the sum of $1,285,523, the amount of the taxes of the latter, which have been in dispute for many years.

BROCTON and North Easton, Mass., are to be connected with a street-railway six and a half miles long.

TWO new street-railways are reported in Texas; one in Fort Worth and one in Brenham.

A STREET-RAILWAY is about to be constructed in Montgomery, Ala.

New Inventions.

Pettengill's Lock for Railway Switches.

PHILANDER L. PETTENGILL, of Elmira, N. Y., has recently invented an improved lock for railway switches, by means of which the switch-levers are adapted to be locked in their two different positions when the switch is opened or closed.

The accompanying cuts illustrate the device and its operation. Fig. 1 is a side view of the lever of a railway switch provided with the improved lock, showing the lever in full lines in one position and in dotted lines in its

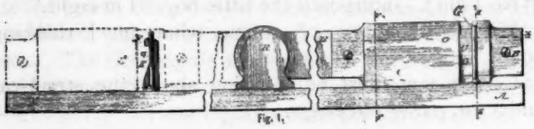


Fig. 1.

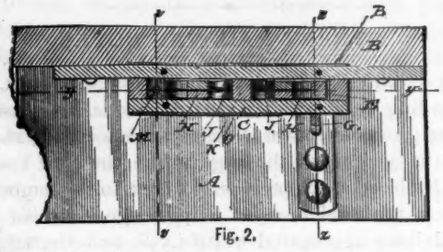


Fig. 2.

PETTENGILL'S LOCK FOR RAILWAY SWITCHES.

other position; Fig. 2 is a horizontal section on line *x x*, in Figs. 1 and 3; Fig. 3 is a vertical section on line *y y*, in Fig. 2, and Fig. 4 is a perspective view of a railway switch in which the lever is provided with the improved lock. The reference-lettering is similar throughout the four cuts.

A indicates the base upon which the lever is pivoted in a bearing, R; and B is the switch-lever which is adapted to be swung to either side, resting with its edges upon the base, and which may be provided with a handle P. Upon one side of the lever, near its outer end, is secured a casing C, having two slots D D, in the upper and lower side piece of the casing—one near the outer end of the same and the other near the inner end—adapted to receive and admit into the casing two lugs E E, secured upon the base, one upon each side of the fulcrum of the lever. These lugs are upright and provided at their upper ends with inwardly-projecting hooks or shoulders F, and two upright guide-lugs G G, are secured upon the base by the sides of the shouldered lugs, adapted to bear against the outer side of the casing when the shouldered lugs or catches E are inserted into the casing. Two shouldered pairs of bolts H H, are pivoted at their ends in the casing, immediately inside the inner ends of the slots, having their free ends sliding in guide-grooves I, in the upper and lower side pieces of the casing, and are adapted to catch under the shoulders of the lugs or catches, and two pairs of springs J J, bear with their free ends against the inner sides of the free ends of the bolts, forcing them outward, having their inner ends secured to the ends of a cross-piece K, in the middle of the lock-casing. The ends of the lock-casing have two transverse slots L L, entering the casing at the free ends of the shouldered bolts, and two pins M M, passing through the upper and lower side pieces of the casing, divide the entrance of these slots. The key has a bifurcated end, the ends entering one upon each side of the dividing-pin in the slots or key-holes, and by pressing the key into the key-hole the bifurcated ends of the same will force the free ends of the pair of pivoted bolts back, releasing the shouldered catch, allowing the lever to be turned. When swung over to the other side of the fulcrum, the lug E upon that side will enter the slot upon the other side of the casing, the guide-lug G guiding the lever, holding the lever in that position until the lock is unlocked by introducing the key into the other key-hole. A casing O, open at its ends, slides upon the lock-casing, the lever being cut slightly away, as shown at B′, to accommodate the same, and is as much shorter than the lock-casing as the distance from the end of the lock-casing to the inner end of the catch-receiving slot D; and it will be seen that when the lock-casing is placed upon the catch the sliding-casing will cover the other catch-receiving slot, preventing dirt or ice or snow from entering

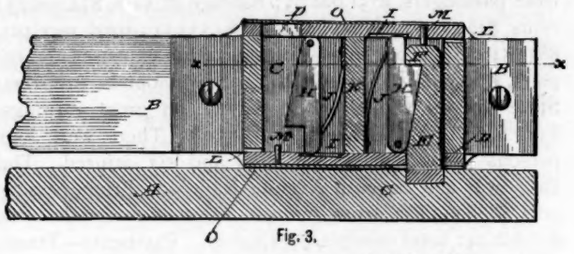


Fig. 3.

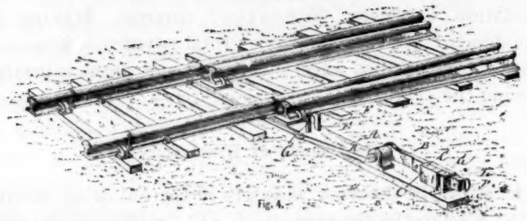


Fig. 4.

PETTENGILL'S LOCK FOR RAILWAY SWITCHES.

into the casing. It will also be seen that by having the pivoted bolts in pairs and by dividing the entrance-slots or key-holes by means of the dividing-pins, the bolts can only be operated by a bifurcated key of the exact proportions, rendering it impossible for persons not concerned to tamper with the lock and switch.

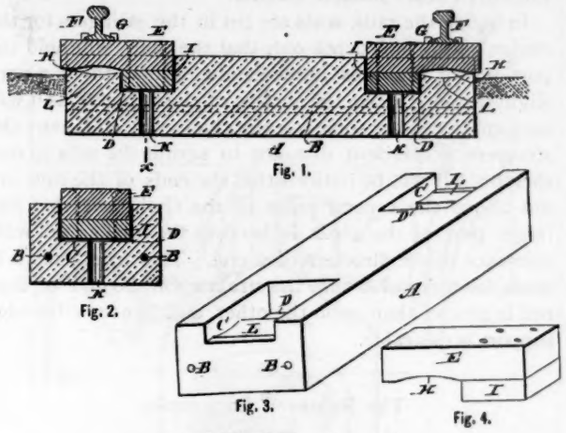
For practical use on railways the double lock can be dispensed with, and only the half used to lock the lever in position for the main line, leaving the other half of the lock-casing vacant, to shut down over a projection when turned for the side track, and to be fastened with hook or pin as is customary in place of locking; but when the lever is turned for the main line it will, being automatic in its action, become locked when the lever is placed in its proper position. In leaving out one-half of the lock the sliding cover becomes entirely unnecessary, as there would be no opening for ice or snow to enter. The single lock can be used on all doors that open and close with sliding or roller movement, such as car-doors, etc., becoming, when in practical use, a cheap and effective lock.

Delffs' Railway-tie.

ARNOLD N. D. DELFFS, of Bedford, Tenn., has recently invented a railway-tie, in which beton, wood and iron are used in the construction. The accompanying cuts illustrate the tie, the reference-lettering being similar through-

out. Fig. 1 is a longitudinal section of the tie; Fig. 2, a cross-section of Fig. 1 on the line *x x*; Fig. 3 a perspective view of the bed-piece, and Fig. 4, a perspective view of a wooden piece to be attached to the bed.

In the construction of the tie the bed-piece A, is made of beton concrete, formed in the usual manner from gravel or broken stone, cement, and sand. These bed-pieces, when molded, will have one or more iron rods or wires B, embedded in the material, extending through the whole length of the tie to strengthen it. In each end of the bed is a mortise C, having in the inner end a recess D, to receive a wooden piece E, extending above the bed, to which



DELFF'S RAILWAY-TIE.

the rail F will be secured by the spikes G. The bottom of the mortise, outside of the recess D, has a downward curve L, extending across it, and the piece E has in the end fitted to lie over this curve a corresponding upward curve H. The end pieces E, of the tie are made of wood, to give to the tie a measure of elasticity, and the curves G and H provide for an increase of elasticity as the rail F is secured to this wood piece directly over these curves. The part I of the piece E, resting in the recess D, holds the pieces in place and prevents the rails from spreading. In the bottom of the recess D is a hole K, through the bed A, to allow any water that might get in the recess to escape.

The curve H, in the end of the bed-piece, may be dispensed with, as sufficient elasticity may be secured without it; but it will usually be preferable with it. In this way, by combining concrete, iron, and wood, a tie is made at a moderate cost, and well adapted to the purpose.

In building a new road the wooden blocks comprising the parts E and I may be made in one piece, while in repairing, the piece I has to be separate and first placed in the recess D. The piece E is then put in place and secured to it.

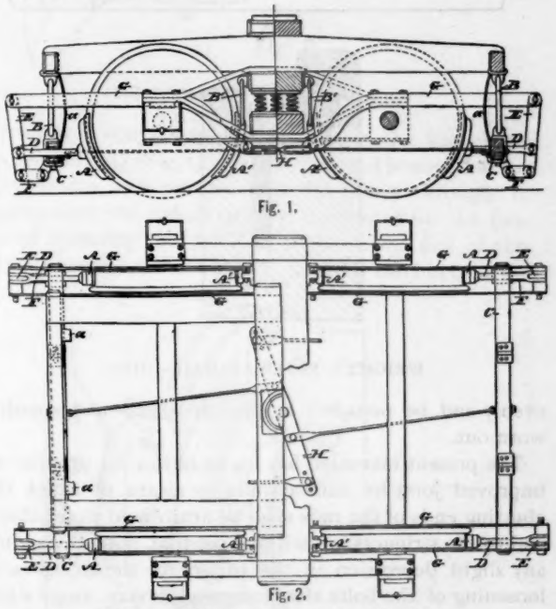
Dwight's Improved Car-brake.

EDMUND W. DWIGHT, of Philadelphia, Pa., is the inventor and patentee of an improved car-brake, which is herewith illustrated and described. The invention consists of a car-brake having its shoes connected in such a manner that they are forced against the opposite sides of a car-wheel, and operate effectively.

Figure 1 represents a side elevation, partly sectional, of a car-brake embodying the invention, and Fig. 2 a top or plan view thereof. The reference-lettering is similar in both cuts.

A A′ represent brake-shoes on opposite sides of a car-wheel, and B B′ the hangers thereof. From the hangers B depend the sliding beams C, through which are freely passed the rods D, one end of each of which carries a brake-shoe A, while the other end is pivoted to an arm E, whose lower end is pivoted to links F, which are also pivoted to the beam C.

To the upper end of the arm E are pivoted the longitudinally-extending rods or arms G, which extend to the other brake-shoe A′, and are pivoted thereto, it being seen that by means of the mechanism described a pair of brake-shoes A A′ is connected and work conjointly, the operation being as follows: The beams C are connected with the brake-lever H and receive power therefrom in any suitable manner, whereby sliding motions are imparted to the beams in the direction toward the car-wheels, the beams riding freely on the rods D. The links F follow the motions of the beams C, and thus draw the lower ends of the arms E with them. This moves the rods D inwardly, whereby the shoes A are forced against



DWIGHT'S IMPROVED CAR-BRAKE.

the wheels, and also moves the upper end of the arm E outwardly, whereby the rods or arms G are also drawn outwardly, the effect of which is to draw the shoes A′ against the wheels, and thus both shoes are powerfully forced against the wheels on opposite sides of the same, and an effective brake is produced. When the lever H is released, the parts are permitted to resume their normal positions and the shoes are relieved, the return motion of the beams C being assisted by suitably-applied springs *a*.

Wright's Railway Rail-joint.

THE accompanying diagrams illustrate a new and improved railway rail-joint devised and patented by Augustine W. Wright, Superintendent of Track Construction of the North Chicago (Ill.) City Railway, and designed especially for use on street-railways. In the construction

of street-railways as at present commonly practiced, it is customary to lay the rails upon stringers, and to connect the abutting ends of the rails by means of chairs or splice-plates upon which the rail ends rest, and to which they are connected by spikes passing through the rails and chairs and embedded in the stringers. An objectionable feature of this construction is that the weight of the cars and traffic upon the rails has the effect, after a time, of loosening the spikes and packing down the fibers of the wooden stringers, and hence depressing their upper surface, so that the joint between the rails and the chairs becomes insecure, allowing the ends of the rails to lie unevenly and be pounded by the car-wheels and speedily worn out.

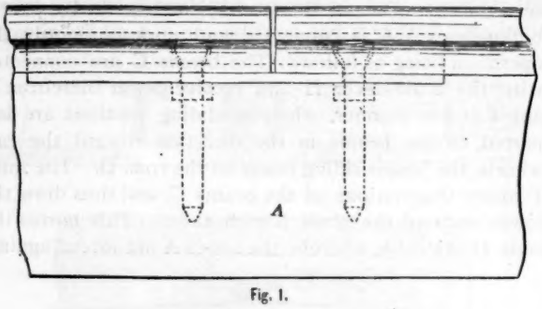


Fig. 1.

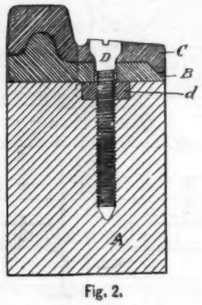


Fig. 2.

WRIGHT'S RAILWAY RAIL-JOINT.

The present invention has for its object to provide an improved joint for railway-rails by means of which the abutting ends of the rails shall be firmly held to the chairs and to the stringers in such manner that, notwithstanding any slight depression in the surface of the stringers, or loosening of the bolts after long and severe usage when the wood has begun to soften, the joint between the chair and the rail ends will remain firm, and the surface of the rail ends will be always in the same horizontal plane, and hence not subject to excessive wear. The invention consists in combining or joining the rails, the chairs or tie-plates, and the stringers or other suitable supports by means of bolts which pass through slots or perforations in the rails and chairs, and are suitably connected to the stringers, such bolts being provided with nuts which firmly clamp and hold the rails and chairs together, regardless of any possible loosening of the bolts in the wood or irregularities of the stringers.

The accompanying cuts illustrate the device and its methods for obtaining the desired ends. Fig. 1 is a view in side elevation, and Fig. 2 a view in vertical transverse section.

A designates a stringer upon which rests the chair B, that supports the abutting ends of the rails C. These rails and chairs are provided with suitable perforations (elongated slightly to allow for expansion and contraction) through which pass the bolts D, that carry the nuts *d*. These nuts *d*, fitting as they do over the threaded portion of the bolts, serve to clamp the rail ends and the chair firmly together, and as they rest within seats in the upper surface of the stringer, and are preferably somewhat oblong, they are thus securely locked against accidental loosening. The threaded portions of the bolts D enter the stringer and hold the chair and rails securely in place thereon. Although bolts are shown, with threaded portions for entering the stringer, they may be attached thereto in other suitable manner.

In laying the rails, seats are cut in the stringers for the chairs, but to such depth only that the chairs will hold the portions of the rails immediately beyond them a very slight distance above the surface of the stringers, as it will happen that after some use the chairs will sink into the stringers a sufficient distance to permit the rails to rest thereon. It will be noticed that the ends of the rails are not above the central point of the chair, but that the larger part of the chair is beneath the further rail with reference to the direction of travel. This arrangement is made for the reason that the strain upon the end of that rail is greater than upon the other, and hence a broader support is desirable.

The Robinson Car-coupler.

WILLIAM ROBINSON, of Bellefontaine, Ohio, is the inventor of an improved automatic safety car-coupler, which is herewith illustrated and described. The object of the invention is to provide an automatic car-coupler which can be operated either from the top or the side of the car, and in which the pin can be set in a raised position and then locked in place, so that the cars cannot possibly couple until it is desired that they shall.

In the accompanying cuts, Fig. 1 represents a front view of the end of a car with the invention applied, showing the device for operating the coupler from the side or top of the car. Fig. 2 is a transverse sectional view showing the draw-head with the coupling-pin raised to await the entrance of the link in the slot of the draw-head, and Fig. 3 a transverse sectional view showing the pin in the position it assumes after the entrance of the link. The reference-lettering is similar throughout.

A represents the draw-head, of any suitable construction, upon the top of which is formed the rib or flange B. Through the top of the draw-head is formed a suitable opening for the pin C to play freely through, and in the front end of the flange B, is made a curved groove which serves as a guide to keep the pin straight in its movement. Pivoted in the front end of this rib or flange, and projecting down into the head, is the trigger D, which has a notch F, made in its upper end, for the projection G on the rear edge of the pin, to catch in. When the pin is raised to its full extent, as shown in Fig. 2, the projection G catches in the recess in the upper end of the trigger, and the pin is supported in this elevated position ready either to couple when the cars run together, or to be held in this position so that the cars cannot be coupled unless it is desired to do so. While the pin is held in this raised position, the lower end of the trigger is forced forward,

ready to be struck by the incoming link of another car, and when struck, unless the pin is locked in its raised position, the pin is tripped and drops at once, as shown in Fig. 3. In the head A, just in the rear of the hole through its bottom for the pin to pass through, there is made a depression H, in which the inner end of the coupling-link can be forced downward, so as to hold it in a slightly

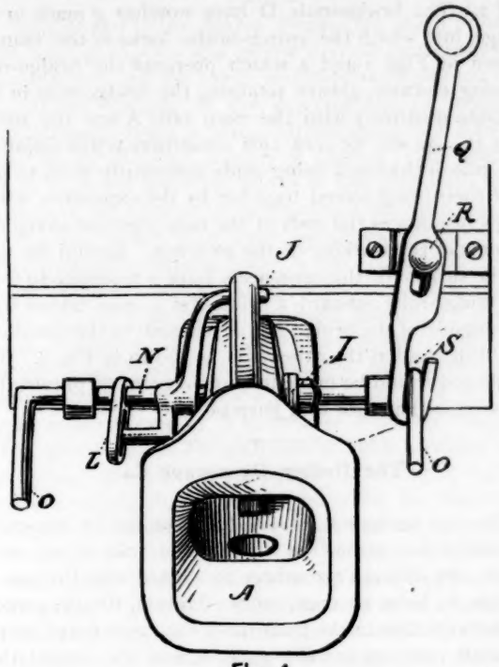


Fig. 1.

THE ROBINSON CAR-COUPLER.

raised position ready for coupling. The projection G, on the pin serves to catch over the inner end of the link and to hold it in position.

Passed through the flange B is the rod or bolt I, which serves as a pivot upon which the bent rod or crank J turns, as shown in Fig. 1. The upper end of this rod or crank is turned upward over the top of the head and passes through the upper end of the coupling-pin. The lower end of the road or crank projects a suitable distance below the bolt I, and is turned outward, so as to catch in the slot in the arm or lever L, which projects downward from the partially-rotating and endwise-moving rod N. When the rod N—which extends across the end of the car and is provided with a handle O at each end—is partially turned, the arm or lever L is moved so as to operate the crank and either raise or depress the pin, as may be desired. The crank being connected to the pin, and to the crank connected to the arm L of the rod N, the pin can only be moved in connection with these parts. A person on either side of the car, by catching hold of one end of the handle O, can raise or depress the coupling-pin without having to go between the cars, and thus risk life and limb.

In order to lock the pin in a raised position, and thus prevent the cars from coupling, except when it is desired that they should, the rod N is given an endwise sliding movement through its bearings, so that the arm L can be made to catch over or be detached from a projection on the side of the draw-head. When the arm is made to catch over this projection, the lower end of the crank is forced forward in such a manner that the coupling-pin is raised to its highest position, and is locked there so that it cannot fall and couple the cars when they jar together. In order to detach this arm from or make it catch over the projection, the rod N must be moved endwise through its bearings.

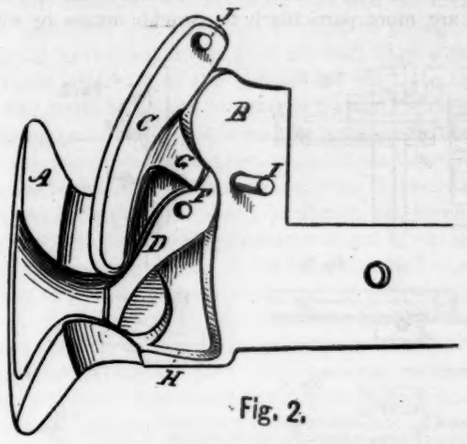


Fig. 2.

THE ROBINSON CAR-COUPLER.

In order to couple and uncouple from the top of the cars, the lever Q (Fig. 1) is used. This rod is slotted at the point where the pin or bolt R passes through it, so as to allow the rod an endwise movement for the purpose of operating the rod N. In the lower end of this rod Q is made a suitable slot, S, where it catches over the

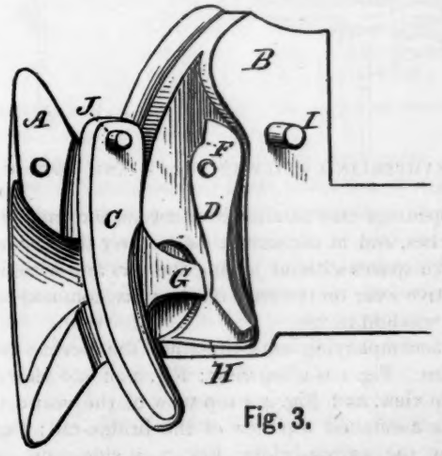


Fig. 3.

THE ROBINSON CAR-COUPLER.

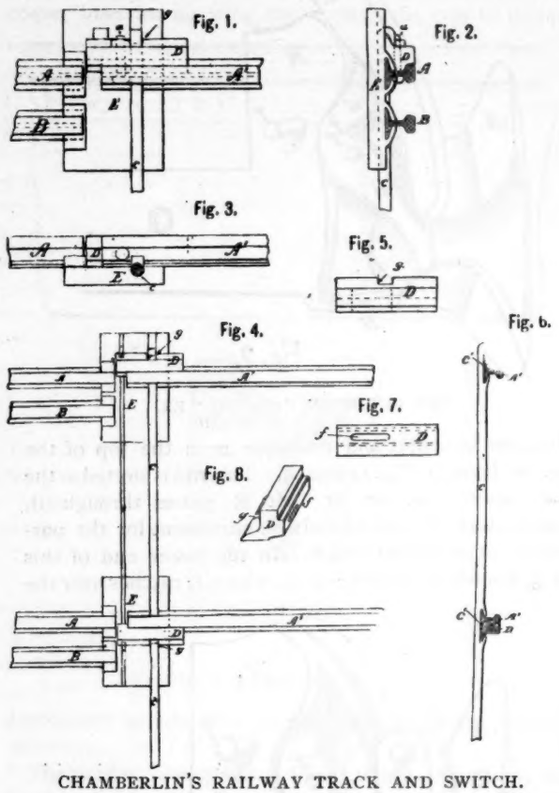
bent end of the rod N, so as to allow a free movement between the parts. A person standing upon the top of the car, can, by this rod Q, both move the rod N endwise and partially revolve it, so as to raise or lower the pin.

It is claimed by the inventor that this coupler will couple to any old-style coupler; that it will operate upon a curve, and that any possibility of breaking or straining the link is avoided. The pin being fastened to the draw-head, it cannot be lost, and the use of the old-style bumper or dead-head is obviated.

A. C. Woolman, of Bellefontaine, O., is the agent of the coupler.

Chamberlin's Railway Track and Switch.

CLARK D. CHAMBERLIN, of Cañon City, Colo., has recently invented a device relating to improvements in railway tracks or switches in which provisions are made for carrying the car-wheels over openings left between the end of rails at switches, made necessary by the longitudinal extension of rails in warm weather and the contraction of the same in cold weather. The objects of the improvements are more particularly to provide means by which



CHAMBERLIN'S RAILWAY TRACK AND SWITCH.

wider openings may be allowed between the ends of rails at switches, and at the same time to carry the car-wheels over such spaces without jarring the cars and without the destructive wear on the ends of the rails common to the present method in use.

The accompanying cuts illustrate the device and its operation. Fig. 1 is a top view; Fig. 2 an end view; Fig. 3 a side view, and Fig. 4 a top view of the entire track. Fig. 5 is a detailed top view of the bridge-rail; Fig. 6, a detail of the switch-bridle; Fig. 7, a side view of the bridge-rail, and Fig. 8, a perspective view of the bridge-rail. The reference-lettering is similar throughout.

The main-line rails A, and the side-track rails B, are permanently attached to one side of the switch-chairs E. The latter is provided with slots for the reception of the switch-bridle *c*, which retains in place and operates the switch-rails A′ and bridge-rails D. The bridge-rails are made from any suitable metallic substance, and extend from the ends of the rails A back along the sides of the switch-rails A′, to which they are attached loosely by means of the pins or bolts *a*, which slide in the longitudinal slots *f* of the bridge-rails. The bridge-rails may be made sufficiently higher than the main rails to meet the tread of the car-wheels when the latter are flaring.

The bridge-rails and switch-rails are placed in position by first placing the switch-bridle *c* in the slots made in the chairs to receive them. The bridge-rails are then placed in the slots *c′* of the switch-bridle *c*, and the switch-rails A′ are slid into the slots *c′* beside the bridge-rails D, when the bolt *a* may be placed in position, as shown in Figs. 1 and 2. The bridge-rails D have notches *g* made in the flange, into which the switch-bridle locks in the manner shown in Figs. 1 and 4, which prevents the bridge-rails moving endwise, always retaining the bridge-rails in immediate proximity with the main rails A and the siding rails B. As will be seen, this construction will admit of the rails of the track being made sufficiently short to prevent their being forced together by the expansion, which frequently forces the ends of the rails together so tight as to prevent the working of the switches. Should the flare of the surface of the car-wheels have a tendency to force the bridge-rails outward, a bridle-rod *e*, may extend from the outside of the bridge-rail at one side to the outside of the bridge-rail at the other side, as shown in Fig. 4. The bridle-rod would be made to slide in grooves provided in the switch-chairs for that purpose.

The Dudley Dynagraph Car.

THE car perfected by Mr. P. H. Dudley for automatic or mechanical inspection of railway tracks is very ingenious. By delicate machinery connected with the axle of the car by belts or cogs, every vibration, tilt, or perpendicular variation in the position of the car is noted on paper with pens set for the purpose, and the record thus made is reduced on paper by the expert in charge, who thus far has been Mr. Dudley himself. Thus a complete and accurate chart of the track in profile and alignment may be submitted to the section superintendents, showing not only the amount and kind of work required to perfect the road, but also the precise places referred to mile-posts on the road where work should be done. The registration of these machines is so perfect that Mr. Dudley can, if the rails are comparatively new, tell, when passing at the rate of twenty miles an hour over a railway, what mills rolled the rails on which he is riding, and knows at once when passing from rails of one manufacturer to those rolled by a different maker. From the record thus made Mr. Dudley makes up a profile map of the road, which, by curved lines, shows, on a scale of one-quarter inch to the mile, the following things: 1. Any irregularities of gauge along the line. 2. Defects in horizontal alignment of the rails. 3. The grades along the railroad. 4. The condition of the track at any point, compared with a perfect track. 5. Whether and how much the track can be improved by labor, or whether new rails alone are needed to make it more perfect. 6. The brand and kind of rails used on each mile of road. 7. The number of years each rail has been in place. 8. The comparative percentage of tangents and curves per mile of road. This map, completed, costs $2.50 per mile, the high price coming mainly from the immense amount of work required to interpret the results, and the delicacy and cost of the instruments used in the work. Mr. Dudley is the inventor of all his instruments, and inspects each year from 6,000 to 10,000 miles of track, living

on his car during these trips. From 3,000 to 5,000 "miles" of paper are kept in the car constantly, and fifteen gallons of ink per 100 miles of track are used in "spotting" low places. The car has recently been employed with great success on an inspection of the Boston and Albany Railroad.

A New Motor.

ACCORDING to the *Boston Transcript*, much interest is felt among experts and others who are concerned in the manufacture and the use of steam-power apparatus in the successful working of the new method of developing steam-power which is being introduced by the New England Motive Power Company of Boston. The apparatus is in constant use at the works of the Hallowell Granite Company, on Medford street, in the Charlestown district. It has been in use there some ten weeks, and gives entire satisfaction in respect both to the economical development of power and the saving of fuel, *i. e.*, about fifty per cent. of coal is saved, and the same amount of power is now developed by the use of one boiler of fifty-horse power, that formerly was produced by this boiler and another one of thirty-horse power. The new method is not, however, wholly a matter of improved apparatus. The chief factor in the gain that is made consists in the mingling of a certain proportion of methylic spirits or pure wood alcohol with the water for the boiler. The proportion has been varied in different experiments, but the engineer of the granite company has derived results most satisfactory on the whole by using ten per cent. of the spirits. The gain comes from the element of alcohol. There is no special virtue in this particular kind of alcohol, and the ordinary alcohol of commerce would serve as well, and might be preferred if it were as cheap. The advantage is that the admixture of alcohol permits the water to be vaporized at a considerable lower degree of temperature, namely, at 169 degrees of Fahrenheit, instead of, in case of water simply, 212 degrees. The apparatus does not require any different boiler construction, but it is an outside attachment which may be adjusted to any boiler. By means of it the compound of water and alcohol may be used over and over again during a period of weeks, so that the cost for alcohol after the first outlay is very slight. The apparatus consists mainly of a condenser in combination with three cylinder pumps. One cylinder is to exhaust steam into the coils of the condenser, and another carries outside the coils a volume of salt water drawn directly from the dock alongside the engine-house. The third is the vacuum cylinder, which is of service in returning the condensed vapor to the boiler. This vacuum cylinder serves also in another way by relieving the direct internal pressure of the boiler, so that while under the former method a pressure, as indicated by the steam-gauge, of sixty-five pounds were employed, forty-five pounds are now found to be sufficient. Another advantage appears in the use of the alcoholic combination in the gain of time required for getting up steam, but about half the time formerly required being now needed. A series of practical tests of this invention—which has been patented here and abroad—is now in progress at the Navy Yard in Washington, and a report, giving results measured with scientific accuracy, will probably appear at an early date.

A Remarkable Invention.

FROM Bridgeport, Conn., comes intelligence of a remarkable invention. It is to do away with the unsightly cow-catcher and make the railroad track a safer place to walk than your own door-yard. It is called the "life-saving engine-pilot." The following lucid description of the contrivance comes from the home of the inventor, and may be considered authentic:

"Mr. Rosenfelt, the inventor, says that the idea of such an appliance first occurred to him by seeing the mail agents on the postal-cars grab the mail bags with the appliance attached to the side of the car. He thought if a bag could be caught by an iron fork and spring without damage why could not a man be handled by making the cushions so soft that his person could not be injured. He has experimented some time, catching chickens and dogs to begin with. He finally perfected his invention sufficiently to pick up his children without harm, and lastly, in testing his invention, it has been attached to a locomotive, and, while running at the rate of forty-five miles an hour it has picked up Mr. Rosenfelt himself, and landed him upon the spring-mattress without harm.

"The life-saving pilot resembles an enormous open work funnel. The mouth opens wide enough to cover the rails. Light steel strips converge toward the entrance of a canvas chute. These slats are delicately balanced and backed up with a number of buoyant springs. The person to be picked up will be scooped, so to speak, into this airy funnel with such a delicate, easy motion as to prevent any concussion. The momentum of the engine will carry the man, woman or child up over the engine, through the canvas chute, and pass him or her on a spring-mattress in the first passenger-car.

"The conductor, it is to be supposed, will collect fare, and, as people will be picked up in this way between stations, they will be expected to be provided with mileage tickets. A colored porter will always be found waiting at the opening of the chute with a whisk-broom and a pitcher of ice-water.

"It seems to us that the only weak point about this otherwise wonderful invention is the fact that it does not discriminate between men, women and children, and mules, cows and calves. It is as liable to pick up one as the other and land them by way of the funnel and deposit the aforesaid mule, cow or calf upon the spring-mattress in the first passenger-car to the consternation of the passengers and the conductor, who will be at a loss how to collect the fare from the quadruped."

To Temper Steel on One Edge.

RED-HOT lead is an excellent thing in which to heat a long plate of steel that requires softening or tempering on one edge. The steel need only be heated at the rate required, and there is little danger of the metal warping or springing. By giving sufficient time, thick portions may be heated equally with thin parts. The ends of wire springs that are to be bent or riveted may be softened for that purpose by this process, after the springs have been hardened or tempered.

THE Swiss railway companies now cover a portion of their carriages with a phosphorescent preparation which makes them visible at night.

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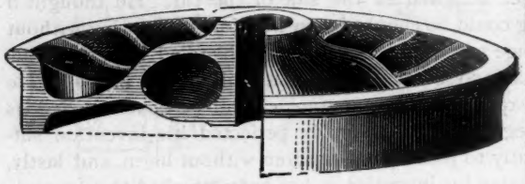

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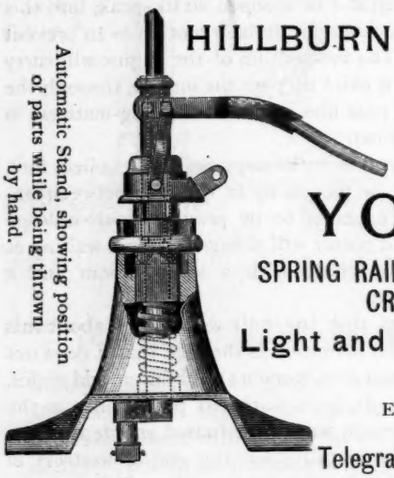

Automatic Stand, showing position of parts while being thrown by hand.

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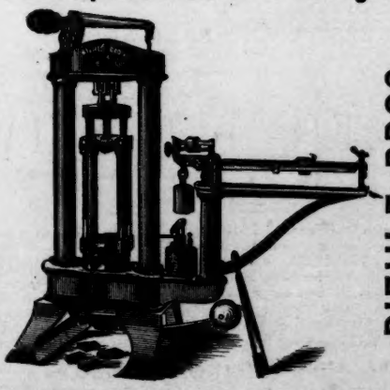

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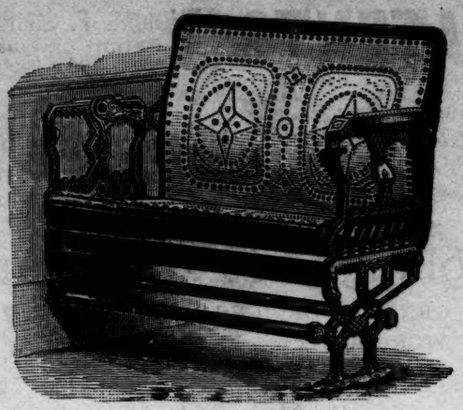

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